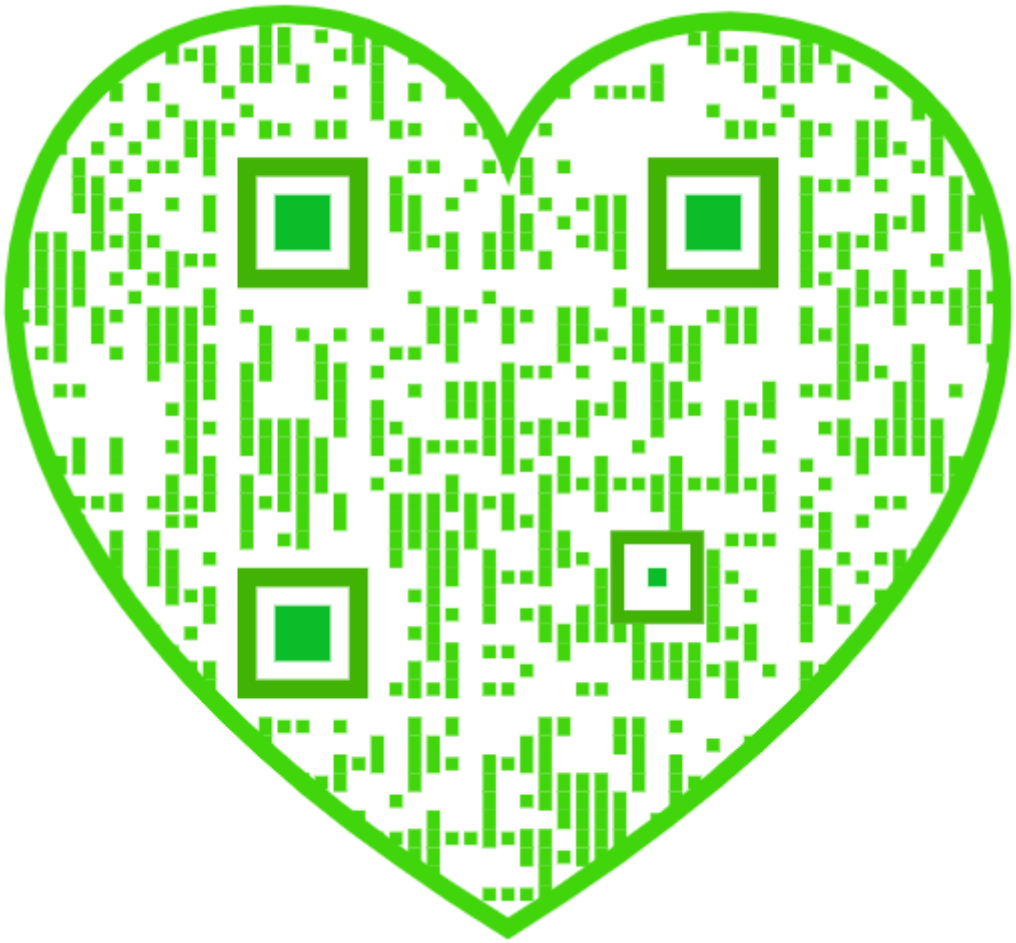

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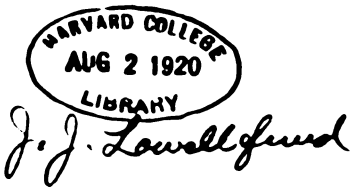

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KEY TO PRONUNCIATION.

ā	far, father
ā	iate, hate
a or ă	at, fat
ā	air, care
ą	ado, sofa
â	all, fall
ch	choose, church
ē	eel, we
e or ĕ	bed, end
ė	her, over: also Fr. *ę*, as in *dę; eu*, as in *neuf;* and *oeu*, as in *boeuf, coeur;* Ger. *ö* (or *oe*), as in *ökonomie.*
ę	befall, elope
ĕ	agent, trident
ff	off, trough
g	gas, get
gw	anguish, guava
h	hat, hot
h or н	Ger. *ch*, as in *nicht, wacht*
hw	what
ī	file, ice
i or ĭ	him, it
i	between e and i, mostly in Oriental final syllables, as, Ferid-ud-din
j	gem, genius
kw	quaint, quite
ṅ	Fr. nasal *m* or *n*, as in *embonpoint, Jean, temps*
ñ	Span. *ñ*, as in *cañon* (cän'yŏn), *piñon* (pēn'yŏn)
ng	mingle, singing
nk	bank, ink
ō	no, open
o or ŏ	not, on
ô	corn, nor
ȯ	atom, symbol
o͝o	book, look
oi	oil, soil; also Ger. *eu*, as in *beutel*
ō or oo	fool, rule
ou or ow	allow, bowsprit
s	satisfy, sauce
sh	show, sure
th	thick, thin
t͟h	father, thither
ū	mute, use
u or ŭ	but, us
u͝	pull, put
ü	between u and e, as in Fr. *sur*, Ger. *Müller*
v	of, very
y	(consonantal) yes, young
z	pleasant, rose
zh	azure, pleasure
' (prime), ," (secondary)	accents, to indicate syllabic stress

THE ENCYCLOPEDIA AMERICANA

W

WASPS, hymenopterous insects, typically belonging to the family *Vespidæ*, in which the head-shield is square and the mandibles or greater jaws short and toothed at their tips. The wings are folded once longitudinally when at rest. The antennæ of the males are 13-jointed, those of the females and neuters or workers 12-jointed. The abdomen is egg-shaped and often borne on the thorax by a slender stalk.

The true wasps differ considerably in appearance and greatly in habits. Some of them live in pairs and construct simple cells of mud which are attached to twigs, beneath stones, etc., and stored with paralyzed spiders and insects upon which the larvæ feed; others burrow into the stems of plants or the ground and provide for the young in a similar manner. All such are known as solitary wasps, to distinguish them from the social or colonial wasps, and are sometimes separated as a distinct family (*Eumenidæ*). The true social wasps are all paper-makers and their nests are sometimes of large size and shelter a great many individuals. Unlike the solitary wasps which are of perfect males and females only, the social wasps produce in addition a caste of "workers" or infertile females.

Eumenes fraterna is a well-known solitary wasp, easily recognizable by the long and slender pedicle formed by the basal segment of the abdomen, the short square thorax, and long jaws. Its nests are dainty spheres about half an inch in diameter constructed of mud pellets and attached, often several in a row, to twigs or walls, and sealed after being provided with a fertilized egg and a supply of caterpillars. *Odynerus* and several related genera having very similar habits have the abdomen sessile. They are often gaily colored and some of them place their mud cells within hollow galls or the deserted nests of other insects. *Raphiglossa* forms burrows in the pithy stems of briers and stores its cells with the larvæ of weevils.

Of the social paper-wasps the species of *Polistes* somewhat resemble *Eumenes* in the slender more or less petiolate abdomen. All of the numerous species build a single tier of cells supported by a central pedicle and unenclosed in a covering. Several of these species are very common and well known. The nests, which begin with a single cell, around which others are added with a large disc two or three inches in diameter, hang from a support by the stem of the original cell, so that the nest resembles an inverted short-stemmed wine-glass. The grubs hatch from the egg laid in each cell as soon as it is finished, and the cells are lengthened somewhat as they grow. They are fed by the mother, and mature and fly in about three weeks. Those first born are females, and these daughters at once begin to assist the mother-wasp in caring for the young hatched later. In the winter nearly all the wasps die, but a few fertilized females hide in shelter-crevices and survive to found new colonies in the spring.

In *Vespa*, the hornets, the abdomen is broad, robust and sessile, and most of the species, which include the hornets and yellow jackets, are brightly striped with yellow on a black or brown-ground color. The members of this genus exhibit the largest and most highly developed wasp communities. A common large species is *Vespa maculata*, the white-faced hornet which builds the large oval grayish paper-nests so well known. Externally they consist of several loose covering layers pierced by an aperture at the lower end. The interior is occupied by horizontal tiers of combs, like floors in a house, supported by columns, and with passages between. Each cell is hexagonal, as in the combs of bees, but the material is paper. These tiers of cells are built in succession, the upper ones first. Sexually wasps are of three kinds, males, females and neuters, the two latter armed with an exceedingly venomous sting. The last are the workers in the hive; they also go out to bring in provisions for the community. Wasps are nearly omnivorous, feeding on honey, jam, fruit, butcher's meat, and any insects which they can overpower. A share of these viands is given to the males and females, whose work lies in the vespiary and in providing for the future progeny of the colony. The cells of a large nest may amount to more than 15,000. In these the females, which are few in number, deposit eggs, hatched in eight days into larvæ. These go into the chrysalis state in 12 or 14 days more, and in 10 more are perfect insects. The males do not work. Most of the workers, all the males and the old females, die at the approach of winter, and in the spring each surviving female, having been impregnated in autumn, looks out for a suitable place to form a new vespiary, and builds a few cells in which are deposited eggs destined to produce workers. The latter then assume the duties of nest-building, and the number of cells is rapidly increased to provide places for the eggs which the female continues

to lay throughout the summer. *V. arenaria* is a smaller species of a richer yellow color and similar habits. The yellow jacket (*V. vulgaris*) builds similar nests in an underground chamber reached by a tunnel, and the large European hornet (*V. crabro*), naturalized in portions of the United Statesñ nests in hollow trees.

The mud-dauber wasps belong to a distinct family (*Sphecidæ*). These have the greater part of the abdomen in the form of a bulb borne on a very long and narrow stalk and the head is supported on a distinct neck. The black and yellow species of *Pelopæus* make the familiar rough mud-cells which are so commonly plastered to the ceilings of barns, outhouses and garrets, and which are packed with spiders at once paralyzed and preserved by a thrust of the sting through the nerve ganglia. Many of the numerous other genera of this family burrow into banks or along paths, but all have the habit of provisioning the nest with spiders or caterpillars. Some of them are very large and handsome wasps. A related family of burrowing or "sand" wasps is the *Pompilidæ*, which have long, non-angulated antennæ, and rather small eyes. A very fine large species (*Pepsis formosus*), found in the Southern States, is known as the tarantula-killer from its habit of attacking that huge spider, with which its cells are stored. Not infrequently in the North a very large wasp, with a stout, heavy body about one and one-half inches long, is seen half flying, half walking, burdeneed by a cicada which it has captured and is bearing off to its burrow. This is *Sphecius speciosus*, a representative of the family *Bembecidæ*, which, like the last two, has the wings unfolded when at rest. Still another interesting family of fossorial wasps is the *Mutilidæ*, or wingless wasps. Most of them are richly colored and hairy; and are seen running in sandy pathways. They are commonly mistaken for ants, and are popularly known as "velvet ants," but sting severely. There are numerous other wasps which cannot be even mentioned. Suffice it to state that the North American fauna includes about 1,500 known species, arranged in 17 families.

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WASSERMANN, August von, German scientist; b. Bamberg, 1866. He studied at the universities of Berlin and Strassburg and was appointed assistant at the Koch Institute, Berlin. In 1902 he was made assistant professor of therapeutics, becoming full professor in 1911 at Berlin University. He became known internationally in 1906 through his discovery of the reaction in syphilis known universally as the "Wassermann test."

WASSERMANN, vä'ẽr-män, Jacob, German novelist; b. Furth, Bavaria, 10 March 1873. He attended the Realschule in his native city, and first went into business, later going into writing at Vienna, where he has been living for more than 20 years. He has great versatility both in the choice of his materials and in the manner of treatment, and has passed successively under the influence of most of the important tendencies and writers of the present day. His most famous novels are 'Die Juden von Zirndorf' (1897); 'Die Geschichte der jungen Renate Fuchs' (1900; 11th ed., 1908); 'Der Moloch' (1902); 'Caspar Hauser oder die Trägheit des Herzens' (1908). He has also written an interesting, rather mystical essay on the art of the narrator, 'Die Kunst der Erzählung' (1904).

JACOB WITTMER HARTMANN.

WASSON, wŏs'ŏn, David Atwood, American clergyman and author; b. Brooksville, Me., 14 May 1832; d. West Medford, Mass., 21 Jan. 1887. He entered Bowdoin College in 1845, but remained only one year; went to sea in search of health; studied law and for a short time practised; and in 1848 entered the Bangor Theological Seminary. In 1851 he became minister of a Congregational church at Groveland, Mass., took charge there of an independent society with which he remained until 1857, with an interval of six months at Worcester, Mass. In 1865 he was called to the 28th Congregational Society (Theodore Parker's), Boston, but soon retired on account of illness. Afterward he resided for several years in Germany, and finally settled at West Medford. A profound thinker and writer, of striking originality, and with a style equally powerful and brilliant, Wasson contributed in prose and verse to various periodicals — the *North American Review, Atlantic Monthly, Christian Examiner, Radical,* etc.— his subjects including political philosophy and government, economics and religion, ethics and social reform. The principal collection of his verse is the volume of Poems' (1888), edited by Ednah D. Cheney, including 'All's Well,' a classic of faith; 'Babes of God,' a pæan of Wasson's optimistic philosophy; 'Seen and Unseen'; 'Ideals'; 'Opheus'; 'Scipio to the Senate,' and others equally striking in thought and expression.

WASTE, *in law,* the result of any act or omission by the tenant of any particular estate by which it is rendered of less permanent value. Waste is of two sorts, voluntary and permissive; the former being that caused by active procedure on the part of the tenant, such as the destruction or alteration of buildings, the removal of fixtures, the cutting down of fruit or shade trees or ornamental shrubs, or in the case of a wood lot, the removal of timber trees and cordwood and their sale for the benefit of the tenant. The latter may, however, cut such timber as is needed and used in the repair of the buildings on the estate. Permissive waste is that caused by negligence, such as the allowing of buildings to fall out of repair. Under the law of waste a tenant may work any mine or quarry already in existence on the leased property unless specifically forbidden in the lease. But he is not permitted to open and operate for his own gain either mine or quarry. In some States the tenant is permitted to clear up wild land for agricultural

purposes; but he must not sell the product of such clearing in cordwood or lumber for his own emolument. On the theory of permissive waste as developed at common law is based the rule which throws upon the tenant the responsibility of making all ordinary repairs in the premises which he occupies. Though he cannot strictly be required to make repairs, and is not liable in damages for any failure so to do, yet in case of an action for waste against him his only defense is a demonstration that he has repaired the waste, and he, therefore, prefers to maintain the premises in repair.

WASTE, or BY-PRODUCTS. Waste is that portion of raw material used in any specific manufacture which is in the process rendered useless for that particular line. However, the name is sometimes retained long after a substance, at one time of little or no value, has been utilized as raw material in some other industry. In every manufacturing process, mechanical or chemical, there is more or less left over material which becomes waste. The examples given below relate to new waste, but nearly everything we use wears or corrodes, or gets broken or unshapely, and so rags and rust and scraps arise. On the other hand, the rust which arises from corroding iron is utter waste, since it can never be profitably collected at all. There is a kind of waste, for the most part difficult to prevent, which goes on in the consumption of fuel, and in certain processes of roasting or calcination in the smelting of metals. Roundly speaking, the best designed steam-engines and boilers require only half as much coal per horse power per hour as those less skilfully constructed, and the fuel unnecessarily consumed by bad boiler furnaces is largely wasted as smoke through imperfect combustion. The utilization of blast furnaces gases for heating purposes, and the recovery of tar and ammonia also produced at the same time from the coal consumed in these furnaces, form an instance of a double saving from the same source. In the report of the chief inspector of alkali works for 1891, it is stated that the plant put up in recent years for collecting tar, ammonia, etc., at 57 Scotch blast furnaces cost $2,223,000, a sum fully equal to the cost of building the furnaces themselves. The condensing flues, miles in length, connected with some lead-smelting furnaces are modern examples for appliances to condense lead fumes or vapor which formerly was allowed to escape, causing much loss of the metal.

Some instances of how waste in a solid form arises in working rock and other mineral substances may now be given. In shaping and dressing granite paving stones as much as three-fourths of the rock quarried is, in some instances at least, wasted. This waste is as yet only in very small part utilized for road metal, and for "granolithic" pavements. Blast-furnace slag is now utilized in several ways, notably in the manufacture of Portland cement. In a number of cases the accumulations of other kinds of slag on the sites of ancient smelting works have, in modern times, been again put through the furnace to extract the metals left in them, with profitable results. Some of the refuse from the old silver mines of Laurium has been bought up by capitalists for this purpose. One instance, though not of very recent date, may be given where, by the salvaging of a by-product, a fortune was very quickly amassed. About 1840 Mr. Askin of Birmingham discovered a method of separating cobalt, in the form of oxide, from nickel, two metals which were very difficult to separate. This oxide of cobalt was at first a waste product, but before very long it was put into the hands of potters, who readily bought it up to produce a blue color on their ware, at the rate of two guineas per pound. Among comparatively recent instances of utilization of by-products and waste products in the chemical industries, we may refer to the importance of the substances now developed from coal tar (q.v.), and the great value of some of them in the manufacture of dyes. Another example is the recovery of binoxide of manganese in the production of chlorine for the manufacture of bleaching powder by Weldon's beautiful process. Formerly for every 100 pounds of bleaching powder made about 100 pounds of the native oxide of manganese were required. Now this manganese is recovered and used again and again in the process, with only a loss of about 5 per cent to make up each time it is returned to the chlorine still. The earlier methods of recovering manganese were not nearly so perfect, and, therefore, were not much used. A process for the utilization of chemical waste on a great scale is Chance's method, patented in 1888, of recovering sulphur from alkali makers' black-ash refuse. A British automobile manufacturing concern salvages 1,200 gallons of cutting oil a week from scrap metal, this oil being used again with the addition of 10 per cent of new oil, the latter being the actual amount of unrecoverable waste. Another establishment treated in one year 83,400 pounds of lathe waste, recovering 2,292 gallons of cutting oil. Large quantities of machine oil are recoverable from rags and cotton waste used for wiping machinery. The process of oil recovery so cleanses the wipers that they are useful again. The year's report shows 350,000 wipers treated, and an annual replacement of only 15,000 new cloths required; and a recovery of more than 5,000 gallons of oil — the total cost of the operation being less than $1,000.

Passing to vegetable substances, the various materials besides rags used in the manufacture of paper may be first noticed. Straw, wood, and esparto fibre, if not exactly waste products, were at least undeveloped substances before they became, as they now are, so largely used in paper making. Old ropes, flex and jute-mill waste, old or torn pieces of paper of every kind, are all serviceable in paper-mills or in the manufacture of millboard. In the pulp of the latter old newspapers bulk largely. Cotton waste is much used by mechanical engineers for cleaning purposes. Sawdust is employed in several ways: in the manufacture of artificial wood, which is pressed into many architectural forms; as a source of oxalic acid, and of pyroligneous acid; and, when compounded with magnesium chloride, as a durable, warm and resilient coating for the cement floors of fireproof buildings. Chips of yellow pine from Southern shipyards yield turpentine and rosin to the waste industry. One of the most interesting developments of all is the manufacture of artificial silk from the wood waste of saw-mills and carpenter shops. The timber

wastes of the United States are prodigious; the estimate for 1913 placing the total at 150,000,000 tons. One of the most effective activities of the Forest Service is directing the salvaging of this waste and its delivery into the hands of establishments which will utilize it. The waste liquors of the wood-pulp industry yield alcohol, adhesives, tanning agents and thymol; and a recently discovered Norwegian process for separating the lignin makes that substance available for fuel — in amount nearly or quite enough to furnish all the heat required in making the pulp. Molasses, a waste product of sugar making, besides being a food, yields large quantities of industrial alcohol at low cost; and, as a by-product to this manufacture, yields valuable potash salts. Corkcutter's waste has become of high importance in the manufacture of linoleum and cork carpet. Cork mattresses and life-preservers, compressed with shellac into new bottle corks, for lining refrigerators and as a substitute for shavings in vinegar making. From the bark stripped from osier wands the useful medicine salicin is now made. In days not so long past the spent madder of our large dyeworks was suddenly raised from a useless to a valuable material by treatment with sulphuric acid, which converted it into the dye called garancin. One of the most interesting examples of what has been done in converting a waste animal product into a highly useful material is seen in the case of waste silk. Cocoons do not yield half their weight of reeled silk, but the remaining "waste" portion has, through the ingenuity of an English inventor, become the raw material for a large spun silk industry. In Venice artificial flowers for ladies' headdresses are made of imperfect cocoons. The various kinds of waste from woolen mills and from the cutting up of woolen fabrics are either worked up again, the short fibre into mungo and the long fibre into shoddy, or it is used for felt or ground into flock for paper hangings. Glue (q.v.) is made from parings of hide and bone, which also yield glycerine. The turnings and dust of the ivory and bone turner have various useful applications. From almost any waste animal matter, such as parings of horns and hoofs, hair, blood, leather cuttings and even field mice, is made the whole list of the invaluable cyanides. The waste of leather cutting is compounded with waste or scrap rubber in the production of a waterproof artificial sole leather. Clippings of fur skins are made into hats and fish scales into artificial pearls. The waste of mother-of-pearl left by button cutters is converted into a fine powder of peculiarly beautiful silky lustre, and used in making artificial flowers and fine wallpapers. The skim-milk residue of butter factories is made into a grade of condensed milk or treated as a source of commercial casein, the whey being worked for its content of milk sugar. The waste bone-charcoal of the sugar refineries is treated with sulphuric acid to make the valued bone phosphate fertilizer. Other materials regularly dealt in by the dealers in waste include old twine, old oilcloth and carpets, books and magazines, old hats, broken glass and old bottles, moss, hair, fur, bones and many others.

The enormously increased prices following the entrance of the United States into the World War gave a market stimulus to the waste industry, owing to the increased values which waste assumed. The larger establishments found it profitable to organize individual salvage departments, in some cases costing into the millions; equipped with complete outfits for treating all sorts of waste. A salient example is the General Electric Company's great plant at Schenectady. The report for 1916 showed that the waste department had handled in that year 80,000,000 pounds of waste, of which 15,000,000 pounds was of scrap metal. Other materials brought to the salvaging shop comprised fibre, rubber, rope, rags, burlap bags and wrappings, remnants of leather belting, asbestos boards and paper, trimmings of cloth, excelsior, box shooks, barrels and barrel staves, etc. Such material as was useless for any other purpose was used as fuel under the boilers, and supplied 53,000,000 pounds of steam in the year.

Smaller establishments disposed of their waste at good prices to one of a large and competitive throng of dealers. The waste trade has its own directory which lists more than 25,000 concerns who either deal in wastes or who use these wastes as raw material in their own industries. Some 1,200 of these dealers are in foreign countries, and not only sell their own domestic waste, but buy at good prices the wastes of American industries.

The trade supports a monthly periodical devoted to its interests. Consult Koller, T., 'The Utilization of Waste Products' (London 1918).

WASTE LANDS, uncultivated and unprofitable tracts in populous and cultivated countries. The term waste lands is not employed with reference to land not reduced to cultivation in countries only partially settled. There is a large extent of waste lands even in the British Islands. Of the 77,800 000 acres which they contain, only about 47,000,000 are arable land and improved pasture; 2,000,000 acres are occupied with woods and plantations; 7,000,000 acres in Scotland consist of sheep-pasture, generally at considerable elevation, and little improved by art; 8,000,000 acres in Ireland are uninclosed pasture, generally quite unimproved; 3,000,000 acres are mountain and bog; and the remainder is unimproved and unproductive.

In the United States, much of the land now practically waste is in this condition merely because the time has not yet come for profitable development of its capacities. A large portion of the area which 40 years ago was known as the 'Great American Desert' has been brought under cultivation and is remarkably productive. With increase of population and multiplication of railroads, much of the land in the west now lying idle will be converted into fertile fields. Many of the "abandoned farms" in the eastern States, some of which have been injured by a bad system of tillage, also will be reclaimed. While there are no authentic figures giving area of waste land in the United States, the following items as reported by the last census are of value in considering the subject:

TOTALS FOR THE UNITED STATES.

	Acres
Total land area	1,903,289,600
Total area in farms	878,798,325
Improved land in farms	478,451,750
Unimproved land in farms	400,346,575

Hence of the total land area in the United States only 46 per cent is in farms and only 25 per cent was classed as "improved" land. Consult Hall, A. D., 'Reclamation of Waste Lands' (in *Popular Science Monthly*, Vol. LXXXV, p. 377, 1914).

WASTES, City, Disposal of. The public wastes of a city may be grouped into three classes: (1) sewage; (2) city refuse; (3) trade refuse. The first class is specifically treated under the title SEWERAGE. The third class consists of such material as earth from excavations, refuse from building operations, manure from livery stables, slaughter-house offal, etc., and the packing litter from stores. This is usually and properly cared for under the law by private contractors. The second class, which must be cared for by one of the municipal departments, commonly the department of street cleaning, is divisible into: (1) household refuse; and (2) street refuse. The first includes garbage, ashes, rubbish (paper, rags, broken glass and crockery, bottles, tin cans, leather and rubber scrap), and general sweepings. The second consists of horse droppings, pavement wear, fallen leaves, dead animals, material falling from carts, and snow. When these have been collected, it is necessary for the department of street cleaning to make the most economical and least obnoxious final disposition of the various products of its activity. Many, and indeed most, of the materials collected have a definite and considerable value when separate from material of other classes, but a mixture of the various kinds of refuse has no value except the little which can be produced by separating the materials by hand picking.

In any large city the proper treatment of these materials calls for their collection in five separate classes: (1) Street sweepings; (2) dead animals; (3) household garbage and market waste; (4) ashes; (5) household rubbish — cans, bottles, paper, rags, bits of metal — and trade waste. When a city population exceeds say 100,000, the amount of waste is sufficient to warrant this classification, because the resulting economies will counterbalance the attendant trouble and expense of keeping and collecting the materials separately.

(1) Street sweepings consist of about two-thirds horse droppings and one-third dust and scrap of one kind and another. These sweepings are not satisfactory as a lowland filling because of the large proportion of organic matter; and on the other hand the material has small value for fertilizing purposes because even well-kept stable manure has a value of only about $2 per ton, wholesale, on the basis of the price of manufactured fertilizers; and street sweepings, from their admixture with other dirt, have a fertilizing value of only about $1.35 per ton. It is evident that such material cannot be shipped far, because its value would soon be equaled by charges for handling and transportation; and the best disposition that can be made of it is to send it out as a farm and garden dressing as far as its fertilizing value will pay the freight. Before the days of high-grade fertilizers, such material had a relatively higher value; but nowadays, only in small cities where market gardens and farms are not greatly distant from the centre of population, have street sweepings any commercial value at the point of collection. In 1840 New York City sold its street sweepings and manure for $38,711; in 1850 the amount received was $30,898; in 1860 the amount was $17,928; and all receipts from this source ceased not many years later. The increasing use of automobiles has reduced the percentage of manure in the sweepings to less than 50 per cent. In smaller cities, however, while the cost of sweeping the streets will apparently always be a charge on the citizen, the value of the sweepings collected from paved streets ought to pay for their final disposition.

(2) In the matter of dead animals, it is customary to contract with some individual or firm for their prompt collection and removal; and though this is considered a service and is nearly always paid for by the city, yet the value recovered by the contractor from the hides, bones, grease and fertilizer-material goes a long way toward equaling the expense of collection and disposal; and there is good reason to believe that the value of this material when scientifically treated is sufficient to meet the total expense.

(3) The third class, household garbage and market waste, is the division which causes most trouble and expense in any city, large or small. In seaport towns it has usually been cheapest and easiest to tow the mixed wastes to sea and to dump them so far from shore as to be practically unobjectionable. Inland cities and towns, however, have found great difficulty in disposing of organic waste, because the method of disposition adopted must be satisfactory at once to the community and to its neighbors. These municipalities have usually endeavored to sell their edible waste, even if not very fresh, for use as food in large piggeries. Many, too, until within recent years, have used it as food for milch cows. The city of Worcester, Mass., feeds upward of 2,000 hogs a year at the municipal piggeries. Colorado Springs, Denver, Kansas City, Omaha and Providence make a similar disposition of city garbage. At Grand Rapids a contractor pays the city 45 cents per ton and feeds 10,000 hogs; his sales reaching $135,000 a year in pork besides 2,400 tons of highly valued fertilizer.

When mechanical methods were sought, the first impulse naturally was to *destroy* an article which had been the source of so much danger and trouble; the second impulse was to *save* a substance which was known to be valuable. The development of these two ideas has led to the invention of incinerating and utilization methods, respectively. The term garbage is used here to signify only table, kitchen and market refuse, consisting of animal and vegetable scrap, always wet and putrescible. The composition of this material varies with the season and with the city, but the average in America is approximately: Water, 70 per cent; grease, 3 per cent; solid fibre, 27 per cent. Such material cannot be burned until its 70 per cent of closely-held water has been freed and evaporated; and, on the other hand, its grease and fibre have commercial value if they can be separated from the water and from each other.

Every housekeeper knows that small amounts of garbage can be quickly disposed of by a good fire; but when the endeavor is made to destroy a large amount of garbage by a poor fire, the

trouble begins. In all cases noxious fumes are produced and escape unless the temperature is 2,000° F. or more, and freedom from offensive odors is gained only at the expense of fuel. The organic fumes must be decomposed and destroyed within the furnace itself and, therefore, the process must be one of complete combustion and not mere evaporation or distillation. When a small amount of garbage is mixed with a large amount of paper, excelsior, shop sweepings and waste coal and clinker the incineration process is neither difficult nor costly; and is permissible in the outskirts of a town or city where there are no neighbors within a mile to be troubled by the fumes which in practice always escape with the chimney smoke and come to the ground at a greater or lesser distance according to the force of the wind. Many city incinerators for this kind of waste destruction are in use in the United States and Canada; many of practically the same class have been in use in England for a long time, and from there the practice has extended to Hamburg and some other places; but none of these incinerators endeavor to burn pure garbage, but always the mixture above mentioned. As a matter of fact, there is enough heating power in a pound of dry garbage to evaporate the water from the next pound, and, therefore, there is no reason why a furnace cannot be so constructed that each pound of garbage may dry the next succeeding pound, and garbage thus be made to burn itself, with only enough added fuel to insure the destruction of fumes. The practice in cities which use incinerators is to collect household ashes with the garbage. These ashes average 20 to 25 per cent of unburned coal, and this is ample for the complete destruction of the garbage at a suitable temperature.

Garbage utilization processes all aim to extract the grease by cooking in steam or solution in naphtha, after which the solid material or fibre is dried and ground to form a fertilizer base. The recoverable grease amounts to about 60 pounds per ton of raw garbage, and is salable at about three cents per pound. The dry fibre averages 540 pounds per ton of winter garbage and derives its value from the presence of ammonia — 18 pounds @ 8c. = $1.44; phosphoric acid — 18 pounds @ 1c. = 18c.; potash — 6 pounds @ 3½c. = 21c., or a total recoverable value of $3.63 from a ton of raw winter garbage. Summer garbage is less valuable because it contains more water and less grease and fibre. The cost of treatment, when the quantity is large, is less than the value of the material recovered. In American cities the amount of garbage collected averages about a half pound per citizen per day; in Europe it averages less than a quarter pound. Many people object to keeping separate garbage cans because of the odors which arise unless the water is absorbed by a mixture of ashes, paper and other waste; but in a large city where garbage is collected daily, it is evident that material which has come from the table within 24 hours must be odorless and unobjectionable, and that the odors arise solely from the cans, and from them only because they are not regularly washed and kept clean. Some cities require the wrapping of garbage in substantial paper parcels. This not only makes for cleanliness but renders incineration very much easier. The per capita production of garbage in the United States varies from 80 pounds (Buffalo, N. Y.) to 260 pounds (Rochester, N. Y.) per annum. In nine of the larger American cities the daily output of garbage varies from 331 pounds to 875 pounds per 1,000 of population. In 1914 the city of New York entered into a contract by which it was to receive $62,500 for its garbage the first year; $87,500 the second year; and $112,500 annually for three years thereafter.

The cost of incinerating garbage in the United States ranges from $250 to $1,000 per annum per 1,000 of population, the average cost being about $600. At Minneapolis the city's wastes are used to produce steam, which lights and heats the charities and corrections buildings, and in addition lights 31 miles of streets.

(4) Ashes are always available for lowland filling and steam ashes are particularly sought by builders for use in fireproof floors, as a foundation for the cement floors of cellars and as a substratum for sidewalks and flagging. The ash output amounts in the northern parts of America to nearly three-quarters of a cubic yard per citizen per year and many efforts have been made to utilize its various constituents so as to save the cost of carting or boating it away for filling purposes. Ordinary household ash from anthracite coal consists of: Fine ash, 50 per cent; coarse ash, stone and clinker, 30 per cent; coal, 20 per cent. Such recovered coal has a ready cash sale, and while the daily value of the ash from a single building is probably too small to pay for its separation, yet the process may be profitable when conducted on a large scale, in proper buildings and aided by mechanical means of separation. This recovered coal has an average heating value of about 75 per cent of that of new coal and has many advantages as household fuel because of its ease of ignition and its freedom from dust, clinker and slate. In the borough of Manhattan, New York, the annual output of ash is per capita, 1,162 pounds, or 3,175 pounds per 1,000 inhabitants daily. This amounts to an average of 12,999 cubic yards in summer and 18,558 cubic yards in winter. The total amount to be handled annually is not far from 5,500,000 cubic yards, or 4,200,000 tons, and the amount of recoverable coal contained therein is not far from 1,050,000 tons. The cost of handling, on the basis of an average haul of three-fourths of a mile, is 96 cents per cubic yard. If the ash collections are kept free from street sweepings and garbage, the recovery may be made by a machine capable of separating coal from clinker; and the value of the recovered coal will be nearly sufficient to meet the expense of ash collection and disposal.

(5) The class of waste including general rubbish — cans, bottles, old rubber, paper, rags, bits of metal, etc.— is a perennial delight to scavengers, who withstand dust and smells in order to pick out these things from a mixed mass of animal and vegetable refuse. But since city authorities have learned to keep the different classes of waste separate, this rubbish has become a source of revenue to the city even after paying the cost of collection and sorting. Old cans are sold at $5 per ton for their solder, tin and value as material for cheap castings. Bottles are of two classes, "registered" goods — bottles which have the proprietor's name blown in the glass — and plain bottles without names. The average

price, at the place of collection, for "registered" bottles, which by law may be sold only to their original owners, is one cent each. Plain bottles are put into barrels and sold to dealers at $1.50 per barrel. Broken glass, too, has a market value of 10 cents per bag. Rubber scrap is worth 15 cents per pound at the rubber reclaiming factories. Waste paper, when clean, is worth from $4 per ton for newspapers to $40 per ton for fine white paper, the average price for the paper collections of a city being about $9 per ton. Rags vary in price, as do papers, many of the rags being used for paper stock. These materials have such value that only a small proportion reaches the carts of the department of street cleaning. The large proportion is collected by house-to-house visitation by junk-cart men, of whom there are in the borough of Manhattan, for instance, some 400, whose purchases amount to about $1,000 per day; and only the balance is collected by the department carts. In many cities the privilege of picking over the "dump" is sold to the highest bidder. In smaller places the pickers are free to exercise their trade for what they can make. An idea of the extent of the trade in these waste materials may be gained from the statement that the yearly collection of old rubbers in the United States amounts to about 17,000 tons, of which some 600 tons per year, worth $50,000, are collected in the borough of Manhattan. Some of the other yearly collections in Manhattan are as follows: "Registered" bottles — principally syphon bottles, milk bottles and those used for carbonated waters, soda and beer — 2,000,000, worth $20,000; plain bottles, 30,000 barrels, worth $45,000; waste paper, $2,000,000 worth; rags, $75,000 worth; bits of carpet, string, iron, brass, etc., to the amount of several thousand dollars more. Though, as said above, only a small proportion of these things goes to the waste heap, yet, since the department has provided separate carts for dry rubbish, the city has received annually nearly $100,000 for the delivery of these collections to contractors at the docks. The various materials are delivered mixed from each cart, and some $150,000 is paid annually by the contractors to laborers who sort the waste into separate piles, after which it is sold to various dealers. Allowing a reasonable profit to the contractors, it is probable that the amount received by them is not less than $300,000. Therefore, these bits of scrap thrown away by the housekeeper have become worth $100,000 by their collection at the receiving station, and have become worth $300,000 by separation into their component parts. The city of New York now employs large motor carts with eight compartments for ashes along the sides and a V-shaped "story" above for rubbish. A crew of eight men operate the car. The garbage is collected separately by a smaller car, with a crew of three. Of the 50 largest cities in the United States, 37 require the separation by the household of garbage, ashes and rubbish. All the cities in New York follow this plan. Of the 158 cities listed in the last census of municipalities, 72 per cent collect their wastes by a municipal force, and 28 per cent let contracts for waste removal to private parties.

The problem of the general separation of waste materials is simple in the household, but difficult in the community. It is all a matter of education in ethics and community economy and requires strict rules with sure penalties for infraction. If each member of the population would increase the salable value of his household wastes one-half cent per day by keeping these wastes separate, the total amount would be sufficient to defray all the expenses of the department of street cleaning in any city in the United States. (See STREET CLEANING). Consult Branch, J. G., 'Heat and Light from Municipal Waste' (Saint Louis 1906); Capes, W. P., and Carpenter, J. D., 'Municipal Housecleaning' (New York 1918); Matthews, E. R., 'Refuse Disposal' (London 1915); Morse, W. F., 'The Collection and Disposal of Municipal Waste' (New York 1908); Venable, W. M., 'Garbage Crematories in America' (New York 1906).

WATAUGA ASSOCIATION, in American history a name adopted by a party of settlers who established the first independent civil government in North America. In 1768, the Six Nations (q.v.) agreed to surrender all the lands between the Ohio and Tennessee rivers. The first settlers were largely from Virginia and the first settlement was made on the banks of the Watauga River in 1769. The Watauga Association, established in 1772 by John Sevier, James Robertson and others, subsequently grew to be the State of Tennessee. Under the title "Articles of the Watauga Association," a written constitution was drafted, the first ever adopted by a community of American-born freemen. See SEVIER, JOHN.

WATCH HILL, post-village in Westerly Township, Washington County, R. I., on the Atlantic Ocean, and about three miles southeast of Stonington, Conn. It is near Watch Hill Point, a promonotory forming the extreme southwest point of Rhode Island. The place has a fine beach and ranks next to Newport and Narragansett Pier, in Rhode Island, as a popular summer resort.

WATCHMAKING, Modern. It is an accepted fact of horological history that the portable mechanism from which has been evolved the modern pocket watch had its origin in Germany. And until the last half of the 19th century the watchmaking industry was confined to a few European countries, particularly to Switzerland and England.

The methods employed by all European watchmakers involve a great degree of individual skill on the part of the various workmen, a skill which can be acquired only by years of application and experience. But as it is the custom in the watchmaking districts of Europe for the children of a family to adopt the line of work pursued by the parents, the acquisition of superior manual dexterity would tend to be both natural and easy. Such skill would, however, lie within narrow limits. For instance, the members of a certain family would for succeeding generations be engaged in the making of a given piece or portion of the watch, one family making wheels, another regulators, another dials, etc. The several parts produced by these various families being brought together by still others, who fitted them to each other and sold them in the form of completed watches. Practically the same methods were in use in the watchmaking dis-

tricts of England. But while watchmaking in England has to a great extent declined, the Swiss are still largely engaged in the business, but their methods have been materially modified through the introduction of American machines.

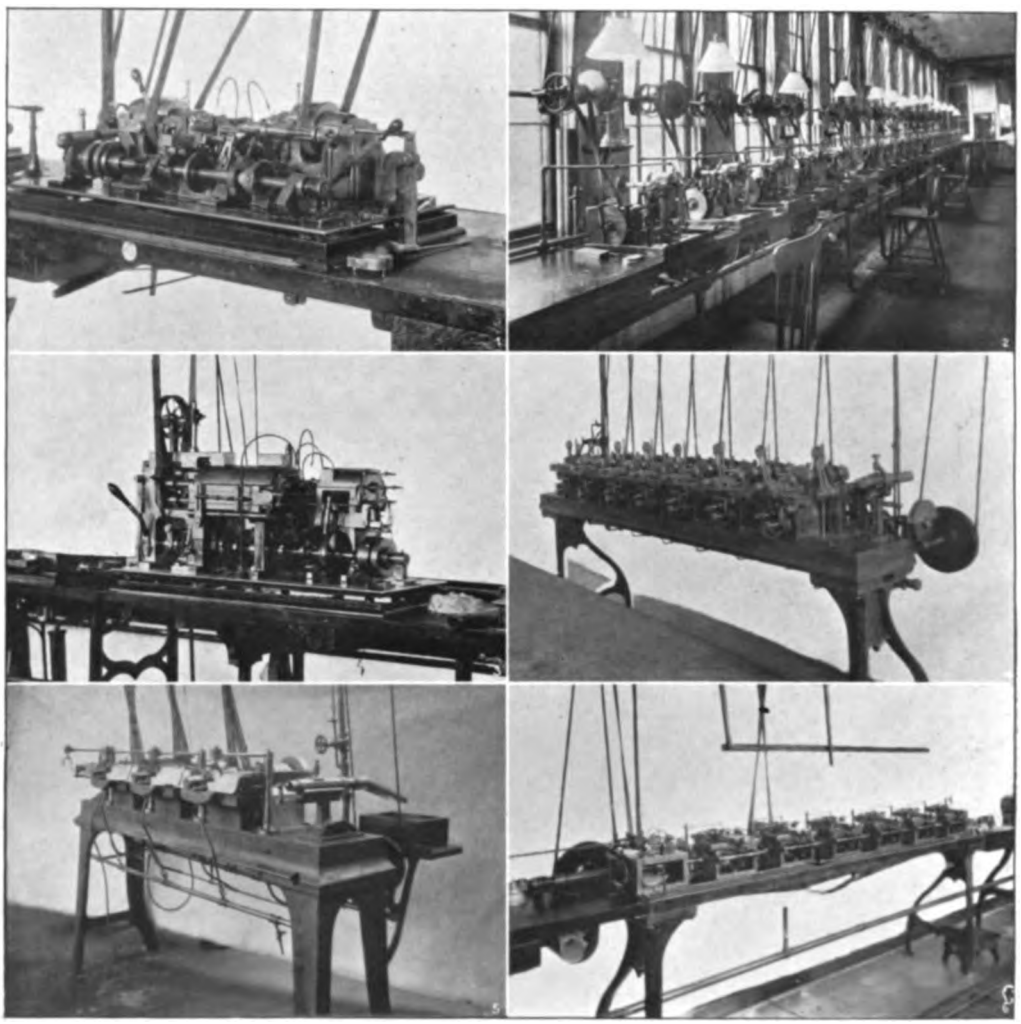
It may be properly said that Europeans made watches by long-used methods, while Americans made a radical departure from established ways and originated a system, the foundation of which may be briefly stated as the substitution of impersonal machines for the acquired skill of the individual workman. A half century of continued growth has given practical demonstration of the correctness of the theory on which this system was founded. It is conceded to have had its theoretical origin in the mind of Aaron L. Dennison, a young Boston watchmaker, who in 1849, after months of planning and endeavor, succeeded in enlisting the co-operation of Edward Howard and his partner, makers of accurate instruments of various forms. Having secured capital to the amount of $20,000, they built a small factory in Roxbury, where about four years was spent in preliminary work and in the production of a few hundred watches. In 1854 a new factory was built in Waltham, Mass., about 10 miles from Boston. This factory, after numerous changes and additions, now exists as the oldest watch factory in America and the largest in the world. Here really began the manufacture of watches on what is now known as the American system, so that it may fairly be said that modern watchmaking belongs peculiarly, if not exclusively, to America. We have said that the American system of watch manufacture employed machines as a substitute for the acquired skill of the individual workmen. The foundation of the system is that of practical uniformity in the form and dimensions of large numbers of any given parts of watch movements, so as to permit of interchangeability.

Manufacturing on the basis of interchangeability may be said to have been in its infancy at the middle of the last century. Doubtless that system had its finest exponent at the time in the United States armory at Springfield, Mass., where were manufactured muskets for the use of the army. Mr. Dennison believed that, notwithstanding the diminutive character of watch parts, as compared with muskets, it would be possible, by the employment of suitable machines, to manufacture large numbers of such parts of such exact uniformity as to be readily interchangeable. The original American watch factory was therefore planned on that theory. But to fully equip a watch factory with tools and machines capable of producing work in that systematic way, would involve the employment of very large capital. The original factory was not fortunate enough to command sufficient confidence of capitalists to enable it to do more than make a beginning, but accomplished enough to demonstrate the practicability of the system. Its development has, however, been continuous, until at the present time machine watchmaking has to a limited extent been adopted in Switzerland, while the old methods of manufacture in England have declined to such an extent that there now remains but a small per cent of the former business.

A watch is really quite a simple machine, containing an average of about 150 distinct parts. By actual count it has been found that the production of all these parts requires over 3,700 distinct operations. It will, therefore, be readily understood that the manufacture of watches on an extensive scale is one of the most complex and exacting manufacturing problems ever undertaken. It calls for high grade talent in almost every direction, and involves an intricacy of detail which can be mastered only by years of study and experience.

This being the fact, it will be hopeless to attempt more than a brief and fragmentary description of a few of the manufacturing processes involved; and it should be understood that the methods employed and the means used are not identical in all American watch factories, but doubtless they are as diverse as the factories themselves. It will, therefore, be best to indicate the most advanced methods only, which in the nature of the case can be found only in a large factory, possessing the absolute requisite of plenty of capital; for high grade automatic machinery is of necessity quite expensive, while at the same time its productive capacity exceeds the requirements of a small factory.

Beginning then with the foundation of the watch movement — the "pillar plate" — it should be said that these larger parts (which in the cheaper grades of watches are of brass, and in the better grades are of nickel alloy) are made at brass mills, from dies furnished by the watch factories, and are received in the form of blank "punchings." After these blanks have been carefully cleaned they are placed in a tubular magazine located at one extreme of a "facing machine" directly beneath a "carrier," which is attached to the extremity of a swinging arm. When the machine is put in motion the carrier descends and grasps one of the plate blanks and lifts it clear of the magazine and swings around to a point directly in front of a suitable chuck or holder on a running spindle of the machine, which at that instant is not in motion. The carrier then descends until the blank is in exact line with the axial centre of the spindle. When in this position the chuck is opened to receive the blank, which is pushed into the waiting chuck, which immediately closes tightly upon it. The empty carrier then rises and swings to a position midway of its excursions. The spindle then begins to revolve at a suitable speed, and at the same time moves forward so as to bring the revolving blank into the path of a suitable cutting tool which at once commences to move toward the axial centre, cutting away a definite portion of the blank and leaving it with a perfectly flat and smooth surface. As soon as the cutting tool reaches the centre of the blank, it is withdrawn from contact and returns to its former position. At the same time a second carrier swings around from the opposite side and places itself directly in front of the chuck containing the faced blank; the grasp of the chuck is relaxed and the blank is pushed out of it and into the second carrier which at once swings around and deposits it in the chuck of a second running spindle — a duplicate of the first. In this second position the other side of the blank is faced; then a third carrier takes



MODERN WATCHMAKING MACHINERY

1 Woerd-Marsh Automatic Roughing Machine
2 A Row of Re-modelled Woerd Pinion Cutters, Self-feeding
3 The Marsh Automatic Screw Making Machine
4 Automatic Pillar Plate Recessing Machine
5 Automatic Watch Plate Facing Machine
6 Automatic Pinion Staff Turning Machine

select a watch movement of any desired size or grade, and also to select from a variety of cases one of such style or weight as best suits his taste. The ability to make independent selections of movement and case is one of the advantages of modern watchmaking made possible by the American system.

The use of special machines was applied to the manufacture of the smaller portions of the watch much earlier than to the production of the plates, as above described; indeed, it may be said that some of the earliest machines employed were semi-automatic. But so radical have been the changes and improvements instituted within the last 15, and especially during the last eight years, that methods previously used can hardly be considered as modern watchmaking.

One of the most interesting of those which are strictly modern is one of the turning of the delicate arbor on which is mounted the most swiftly moving wheel of the entire watch, the "balance." The fact that this wheel moves with such rapidity, together with the fact of its location at the farthest point from the reservoir of power, in the mainspring, makes it absolutely essential that it should be subject to the least possible amount of running friction. Consequently the pivots of this "balance staff" are exceedingly minute. It is, of course, an absolute necessity that every portion of the staff, including the delicate pivots, should run absolutely true. Exact truth was a difficult attainment under the methods ordinarily used, although great care was used to avoid any stress or distortion of the staff, by a very gradual reduction of the blank, so that 10 to 14 separate turnings were required to complete a staff. By the most approved modern methods and machines, all of the required turnings, including the pivots, are performed before the completed staff is severed from the rod of wire from which it is made. So complete is the machine, and so accurate and rapid is its operation, that a staff is delivered from the machine each 90 seconds.

The pinions of various sizes, which compose so large a portion of the time train of the watch, are formed from the best quality of steel rods and, as this wire must of course have a diameter as great as the largest part of the pinion, it follows that a large proportion of the material must be removed to bring the pinion to its finish dimensions. An early method consisted in first cutting the wire into blanks of sufficient length, then to insert those blanks in a suitable chuck in the running spindle of a lathe and with a suitable tool to remove the metal from the projecting end so as to bring it to an accurate point or centre. The blank was then reversed in the chuck and the opposite end pointed in like manner. In some instances a portion of the excess metal was removed in connection with the operation of pointing.

Following this somewhat crude method of pointing and initial turning, came the invention and adoption of so-called "roughing out machines," in which a rod of wire is inserted in the machine which automatically cuts off, points and turns the blanks on both ends and delivers them uniform in dimensions and requiring only the slight finish turnings and the cutting of the teeth when they will be ready for hardening and tempering.

A later form of machine has been devised, which takes a rod of wire at one end and delivers the pieces "finish turned" at the other end.

The finished blanks are then placed in a magazine or "feeder" in a cutting machine which automatically takes them one at a time and forms the teeth of the required number and shape, the work of the attendant being to keep the magazine supplied with blanks, and to examine the pinions occasionally in order to detect any imperfections; so that a single person can easily attend six cutting machines. For the greater convenience and comfort of the operator a chair is fitted to run on rollers on an iron track on the floor. These rolling chairs are also provided in connection with numerous other machines where a single person attends to a number of machines.

Within two or three years D. H. Church of the Waltham factory has created machines in which pinions are completely turned and the required teeth are cut. All the work being automatically performed, so that completed pinions are made, the last operation being to sever the finished pinion from the rod of wire from which it was formed. The exactness with which these machines operate makes possible the production of pinions which could not have been produced with tools and machines in previous use.

As each watch movement required from 30 to 50 screws it will be evident that for a daily product of more than 2,500 watches more than 100,000 screws would be required. By the earlier methods employed in American watch factories an active man could make from 800 to 1,200 screws per day so that more than 80 men would be required for the production of this large number. But within a few years screw-making machines have been devised which are capable of making from 4,000 to 10,000 screws each per day, and being entirely automatic in action, a single attendant is able to attend six or more machines.

The almost absolute uniformity in the operation of the most improved modern watchmaking machinery insures a resulting product so uniform in quality and dimensions as to make needless the minute "fitting" operations which are indispensable in work produced by even the earlier American methods. So accurately is the work performed that many of the most delicate portions of the watch, whose exact performance is absolutely essential, do not come together until all the finished parts meet for the final assembling.

It may appear strange, but it is nevertheless a fact that, by modern methods, watches are not made by watchmakers, as that term is generally understood, but by machines, by which it is to be understood that the component parts of the watch are all fabricated by machines designed for that special use and purpose. When those individual parts are finished and collected so as to suffice for complete watches they are assembled for the first time and when each part is in its proper place and the watch is "wound" it is run for a period of one hour, which is sufficient to determine whether it is inclined to run faster or slower

more delicate adjustments must be provided. It will be observed that on Figure 8 the locations of the balance rim screws are numbered from 1 to 12 on each half of the balance. Also note that screws numbered 1 and 6 have shorter

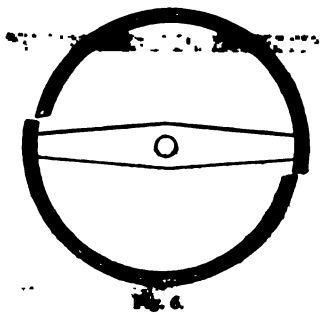


Fig. 6.

heads and longer bodies than the others. Also note that while these four screws are screwed in only part way, the others are screwed down to the head. These four screws are designated as "meantime screws," since by *screwing*

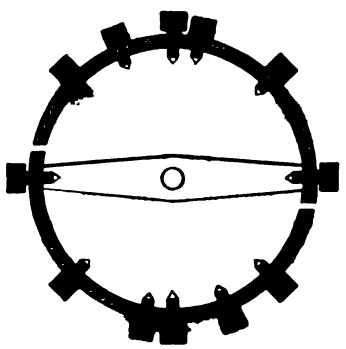


Fig. 7.

them in further the active diameter of the balance is reduced, that is, while the actual weight of the balance remains unchanged, a very minute portion of the weight is carried nearer to the centre of the balance, with the

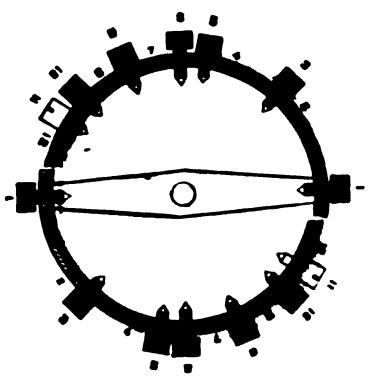


Fig. 8.

result of very slightly increasing the rapidity of its vibration. A watch balance vibrating precisely 18,000 times each hour will keep perfect time. But if it should vibrate 18,001 times an hour the *watch would gain two and two-fifths minutes in a month.* Suppose that owing to a change in temperature the self compensation of the balance, as before described, should be insufficient, and the watch should *lose, because of the increase in heat,* it would show that it was "under compensated." In such case it might suffice to simply change the location of some of the rim screws, for instance, to move screws number 4 to locations number 11. Such a change of location would not at all *affect* the *actual weight* of the balance, but *would modify the vibrational weight,* because when the screws were in location 11 they would be near the free end of the rim, and the distortion of the balance rim would carry more weight toward the balance centre and in effect maintain the effective diameter of balance and keep its speed of vibration unchanged. It must be realized that *these changes are real,* though so infinitesimal.

A second factor is that of *position,* as it affects the running friction through the influence of gravity, inertia and friction. These two factors of temperature and position are *real,* though somewhat intangible, and call for the exercise of the highest skill of the watchmaker and constitute what is called "Adjusting." The means for "temperature adjusting" have already been described, and as the processes of "position adjustment involve such a variety of delicate manipulations of the balance and its pivots and also of the accompanying hair-spring, any attempted description of the process would be useless. It should be said that the obtaining of *correct adjustment* involves a series of 24-hour trials in the established extreme variations of 50°, i.e., between 40° and 90° Fahrenheit, and also in not less than three "positions" while the highest grades require to be adjusted to five positions.

A watch has been generally understood to mean a small timepiece in portable form, usually to be carried in the pocket. In later years, however, watches have been made in sizes and forms suitable for use as articles of convenience and ornament especially adapted for ladies' wear. One of the triumphs of automatic machinery has been the production of watch parts so extremely delicate as to make possible the construction of watch movements so small as to be covered by a dime. On the other extreme of size portable timepieces are made to *run eight days.* Movements of this size have come into extensive use on motor cars and as desk watches, etc. Movements of this size are also made of special grade and cased in the form of ship chronometers and are coming into extensive use for navigation, the United States government having hundreds of them in use.

A person who has not given careful thought or study to the matter of time-keeping can have but little conception of the extreme minuteness of the deviations from absolute perfection of rate which have been attained by modern timekeepers. On the other hand, to one who has given the subject careful consideration, it seems almost marvelous that mechanism can be created which makes possible the marking or determination of such almost infinitesmal time intervals as are taken into account in ascertaining the longitude of

decided upon; first as 18, later as 36, and it is now accepted as probably 72.

Water is a tasteless, inodorous liquid, under usual conditions, colorless; but when a great thickness of it is examined, as in looking endwise through a pipe filled with it, it is found to have a distinctly blue tint. At all temperatures below 32° F. it is a solid and at all temperatures above 212° F. it is a gas. When water at 32° is heated it contracts until it reaches the temperature of 39.2°, after which it expands; conversely, when water at 212° is cooled it contracts until it reaches the temperature of 39.2°, after which it expands; 39.2° F. is called the point of maximum density of water; the specific gravity of water is greater at this than at any other temperature. The fact that water expands on cooling from 39.2° to 32° is a most important one. If a sheet of fresh water be cooled, the upper layers become more and more dense; they, therefore, tend to sink, and so fresh surfaces are exposed to the cooling influences. But when the temperature of the mass of water has reached 39.2° further cooling of the surface causes an expansion of the upper layers, which continues until these solidify into ice; these layers of cold water consequently float upon the warmer water underneath; hence it is impossible for the mass of water to suddenly freeze throughout. When water passes from the liquid to the solid state it expands to the amount of about 1-11h of its volume; that is, one volume of water forms 1.0908 volume of ice. This expansion is sufficient to bring about a large quantity of mechanical work, and to it the bursting of water-pipes during frost is to be largely traced. When solid water becomes liquid, or when liquid water becomes gaseous, a considerable quantity of heat is absorbed and disappears, or, as the expression is, is rendered "latent" Steam issuing from boiling water is no hotter than the water itself; water formed when ice is melting is no hotter than the ice itself; yet heat is being communicated to the ice and to the water. The latent heat of water is 79 thermal units; the latent heat of steam is 536 thermal units, although by the thermometer the temperature remains unchanged. In other words, in order to convert unit weight of ice at 32° into water at 32° a quantity of heat must be communicated to the ice, which, if communicated to unit weight of water at 32°, would raise its temperature to 79° C. In order to convert unit weight of water at 212° into steam at 212° such a quantity of heat must be communicated to the water as would suffice to raise the temperature of that weight of water through 536° C., or 536 times that weight of water through 1° C. Before water can become steam the upward pressure of its vapor must overcome the downward pressure of the atmosphere; hence it follows that the boiling point of water is conditioned by the atmospheric pressure. Water boils at a much lower temperature on mountain tops, where the pressure is comparatively small, than in the valleys. Water is almost incompressible. At 32° it is diminished in volume only by the fraction .0000462 for each atmosphere (15.7 pounds) of pressure added.

The solvent power of water is very large. As a rule hot water dissolves larger quantities of solid matter than cold. Water is found in nature in many forms — vapor, dew, hoar-frost, rain, hail, snow; besides the several distinct variations of spring water, well water, river water, surface water, sea water, etc. As has been mentioned it is never found in a state of purity. Analyses of dew and hoar frost show from 2.64 to 8.00 parts of solid impurities in 100,000 parts of water. These are organic carbon, organic nitrogen, ammonia, nitrates and nitrites, chlorine, lime and magnesia. These substances have been held in solution in the vapor of water in the air. Snow will gain in ammonia content the longer it lies on the ground.

Rain water, when collected before it touches the earth, contains only such impurities as may be derived from the atmosphere, chiefly consisting of oxygen, nitrogen and carbon dioxide, with more or less nitric acid and ammonia in the case of thunder showers. The rain water of towns contains comparatively large quantities of sulphurous and sulphuric acids and of soluble salts. The amount of these substances may be taken as an estimate of the comparative purities of the atmospheres of different towns. Rain water collected near the sea is rich in chlorides. Samples of rain water taken in a farming country near the sea have shown 42.8 parts of solid impurities per 100,000.

River water varies greatly in so far as the nature and quantity of the substances held in solution by it are concerned. The soluble constituents of river water are chiefly such as may be derived from the rocks through which the water of the springs which have fed the river has percolated and the amount of surface water it has received owing to storms. The dilution of the original spring water by the continual influx of tributaries reduces the relative quantity of solid matter held in solution, while the escape of carbon dioxide during the exposure of the surface water to the air causes the precipitation of those salts which were held in solution by the aid of the carbonic acid. River water is often largely contaminated by the drainage of towns or of manufactories situated on the river banks.

Spring Waters.— The soluble constituents of spring waters are various. In some springs the quantity of dissolved solid matter is but trifling, while in others it amounts to 2,000 grains per gallon. Spring waters are usually divided into classes in accordance as one or other dissolved constituent predominates. See MINERAL WATERS.

Sea water is essentially an alkaline chlorinated water. The quantity of solid matter held in solution varies in the waters of different seas. Inland seas, as a rule, contain less solid matter than the ocean; thus the solid content of the water of the Black Sea amounts to about 1,760 parts per million, while that of the Baltic averages 17,700, and that of the Atlantic Ocean 36,000 parts per million. The substances held in solution in sea water are chiefly chlorides and sulphates of sodium, magnesium and potassium, together with iodides, bromides and carbonates, chiefly of potassium and calcium.

Use of Water.— In considering the suitableness of a water for domestic use attention should be principally paid to (1) the source of the supply, (2) the total solid matter held

point of view the book is a vivacious argument for faith, designed on the one hand to make readers less assertive and dogmatic and also to render them more receptive of the underlying, if undemonstrable, mysteries of the Christian religion.

WILLIAM T. BREWSTER.

WATER BALANCE, an oscillating pendulous frame, having a series of troughs in vertical series and inclined in alternate directions, so that, as the frame oscillates, the water dipped by the lower one shall be poured into the next above, which, on the return motion, shall pour it into the next, and so on.

WATER BAROMETER. See BAROMETER.

WATER-BEARS. See TARDIGRADA.

WATER BED, a watertight mattress or bed for relieving any partial pressure of the body of a patient long confined to bed and so preventing the formation of ulcers which arise from such local pressure. One form is that of a trough half-filled with water, covered by a loose lining of india-rubber sheeting attached all around to the upper edge of the trough so as to be watertight, a mattress being laid between the invalid and the lining. Another form is that of a large waterproof bag which is laid upon an ordinary mattress and half-filled with water, the weight of the body resting upon this directly or with bed clothes between.

WATER-BEETLES, the numerous species of beetles which inhabit water. A common mode of life does not indicate blood relationship, and the various aquatic beetles belong to a number of quite distinct families. Besides those which are aquatic throughout their lives quite a large number of beetles live in or near the water only during the larval period. The strictly and permanently aquatic beetles belong chiefly to three families. The diving beetles (*Dytiscidæ*) are predaceous throughout life and represent in the water the *Carabidæ*, to which they are somewhat closely related, on land. The legs in these insects are adapted for swimming, the two hinder pairs being flattened and fringed with hairs. The body is oval and flattened. The mandibles are short and strong and the thorax is broad. The front legs are short and the antennæ long and filiform. In the genus *Dytiscus* the tarsi of the males are wide, flat and provided with sucking discs, while those of the females are unmodified. The females are of two forms, the one having the wing-covers smooth, the other grooved. The head is short and received into the thorax. *D. fasciventris* is the common water-beetle of our ponds. These insects carry a supply of air for breathing beneath the *elytra* or wing-covers. At evening they fly in the air. They are eminently carnivorous in habits and feed on other insects. The larvæ are active creatures and are also aquatic; their noteworthy rapacity has gained for them the name of water-tigers, which they well merit, for they will not hesitate to seize in their sharp sickle-like jaws any insect-larvæ, small fish or tadpole that comes within reach, and after draining its juices discard the dead body. The tail is terminated by a pair of respiratory tubes which are raised above the surface of the water to effect respiration. Besides this large species the family includes numerous small ones having similar habits. The other two families have club-shape instead of filiform antennæ.

The *Gyrinidæ*, or whirligig beetles, have the antennæ short, the front legs long, clawed, and in the males provided with a spongy disc, the second and third pairs of legs very short, broad and paddle-shaped, and the elytra do not cover the tip of the oval body. They derive their familiar name from their peculiar habit of describing circles on the surface of the pools they inhabit. When alarmed these insects dive to the bottom and anchor themselves for a time by means of the strong front legs, carrying with them a small bubble of air on the tip of the abdomen. Owing to their smooth, polished and oily surface they are unaffected by the water. The facets of the compound eyes are divided into two groups on each side, one adapted for vision in the water, and looking downward, the other for looking upward in the air — an important adaptation to the peculiar mode of life of these insects on the surface. When handled, the whirligigs emit from the joints a peculiar strong-smelling milky fluid. Although, like the *Dytiscus* larvæ, the young of the whirligigs are predaceous, their appearance is totally different; they are of slender form and, instead of a single pair of caudal respiratory tubes or gills, they bear 10 pairs of fringed lateral gills on the sides of as many abdominal segments. Several other genera and species are common in ponds.

The largest of the common water-beetles belong to the family *Hydrophilidæ*, which also includes numerous small and inconspicuous species. In the form of the body and the fringed oar-like middle and hind legs they resemble the *Dytiscidæ*, from which all the members of this family are distinguished by their short strongly-clubbed antennæ. The eggs are deposited in silken cocoons attached to water-plants or carried by the female. In general resembling the water-tigers in form, the larvæ have shorter, thicker, solid jaws, much less prominent respiratory tubes and are less active, although, like them, carnivorous. They pupate in burrows in the banks of the ponds which they inhabit. The great water-beetle (*Hydrophilus triangularis*) is a pitchy black polished beetle an inch and a half long, often seen flying at night or during the day rising to the surface of clear weed-grown ponds for air and, unlike the *Dytiscidæ*, usually resting head upward. In adult life they forsake the predaceous habits and animal diet of their larvæ and become scavengers, finding their food chiefly in the vegetable debris at the bottom of ponds. Few inhabitants of fresh-water ponds and ditches are better suited to life in an aquarium than these beetles and few present a greater variety or more interesting habits. Consult standard works, especially Miall, 'The Natural History of Aquatic Insects' (New York 1895) and Kellogg's 'American Insects' (New York 1909). See FRESH-WATER INSECTS.

WATER-BOA, the anaconda snake. See BOA.

WATER-BOATMAN. See BOAT-FLY; WATER-BUG.

WATER BRASH. See PYROSIS.

WATER-BUG, an aquatic bug of the hemipterous family *Notonectidæ*. The hind legs are long and adapted for swimming by being provided with a fringe of stiff hairs. The body is prismatic in form, convex above and flat beneath, and the head is as large and as wide as the body. *Notonecta* is the typical genus of the family and *N. irrorata* and *undulata* are two of the common species. These and others abound in ponds and streams, where they rest on their backs at the surface, occasionally striking out with a vigorous oar-like movement of the hind legs, or dive to the bottom and cling to plants or stones. They are constantly buoyed up by a film of air which surrounds the abdomen, partly entangled in a coat of close fine hairs, partly held between the wings and the abdomen in a space into which the spiracles open and partly between the joints of the abdominal and thoracic segments. On land the water boatman are at a disadvantage and progress by a series of spasmodic leaps; but they are agile fliers. As larvæ, nymphs and imagoes they are predaceous and, besides strictly aquatic insects, young fishes, etc., they attack and suck the juices of flying insects which happen to fall into the water or approach its margin to drink. Various other hemipterous insects, such as the water-scorpions (q.v.), are aquatic. The croton bug is not truly aquatic, but is called a water-bug because it frequents water-pipes in cities.

WATER-CLOCK. See CLEPSYDRA.

WATER-COLOR. See PAINTING, TECHNIQUE OF

WATER-COLOR PAINTING, in contradistinction to oil painting, the use of water generally interfused with gum arabic as a vehicle for applying colors, very often transparently, to a white surface. Anciently, there were three distinct methods of water-color painting, and these were known as tempera, encaustic and fresco. Tempera, or as it was sometimes called, distemper painting, was common in early Italian art. (See PAINTING). The colors were ground and mixed with the beaten-up white and yolk of an egg, or with the white juice of the fig tree, and sometimes with ox-gall. Encaustic painting was a process in which the colors were mixed with wax and laid in a thin coating, then fixed by the application of hot irons. The early Flemish and Dutch painters attained considerable success by the use of water colors in the medium of tempera, long previous to the invention of oil painting by the Van Eyck brothers. The Italian frescoes are painted in water color, on damp plaster and have retained their colors scarcely impaired for centuries. See FRESCO PAINTING.

But when we speak of water-color painting in a modern sense we refer to the aquarelle. The ancient Egyptians used water-color to decorate their papyrus rolls, and the monks of the Middle Ages employed it to adorn vellum manuscripts; but this was all impasto, not the transparent washes, as in modern English work. This process and manipulation was the outgrowth of the methods worked out by Paul Sandby (1725–1809) and advanced by Alexander Cozens, creating an entirely new type of fine art productions known as aquarelles. The former treatment of the water-color work on white paper was really a species of sketching in outline certain scenes then filling in the spaces with water-color (color printing). In the aquarelles the brush supersedes the pen (or pencil). Thomas Girtin (1775–1802) perfected the method and produced pictures disclosing consummate genius, and the novel charm of light and shade in nature as a fine art with transparent washes was revealed to admiring connoisseurs. These were the precursors of a talented English school. In the English school there has been no exclusive use made of what is known as body color. The lightness and darkness of each tint have generally been determined by the degree of their dilution with pure water, not by their modification through an admixture of Chinese white.

In early painting the pigments employed were generally mineral earths or juices pressed from plants. The colors found in antique frescoes were few but permanent in value. In the Middle Ages chemistry came to the aid of the fresco painter and supplied him with many brilliant and permanent tints, which is some instances vied with the lustre with which the church window maker stained his glass. The modern water-color painter has gained innumerable additions to the color range of his palette, and the freshness, crispness and unerring certainty of his touch have been largely due to the beauty, clearness and permanency of the colors in which he has worked. Manufacturers have, indeed, vied with each other in providing him with pigments which shall flow smoothly from his brush and stand projected with nature's beauty upon his paper. While the modern water-color painter aims at producing his effects by means of transparent washes, artists have not always considered it illegitimate to resort to the use of body color in their efforts to impart to their work the depth and solidity of oil painting.

Technique.— The necessary apparatus of a water-color artist's studio is simple and consists of paper, drawing-board and drawing-pins (push pins), palette, pigments and brushes. Many use an easel, but a number rest the drawing-board on their knees or on an adjacent piece of furniture (table, etc.). To avoid the paper from crinkling or cockling when the water washes are applied it is necessary to stretch the paper, by wetting it with water and fastening it firmly to the board by pins or mucilage around the border. While there are differences of opinion as to what paper to select, there is a limit to the number of makes acceptable to any artist. All used surfaces, grains, textures, etc., are comprised in the following list: Whitman, Allenje, Michallet, David Cox, Creswick, Varley, cartridge, Van Gelder, white Canson and Burlington.

Pigments.— The colors used by the early aquarelle masters were made up into little hard bricks (cakes) and were rubbed out in water on a porcelain surface, but a more recent, perhaps more convenient, form of pigment preparation consists of moist colors, requiring less manipulation before being ready for the brush. Light-red, yellow ochre, cyanine blue, ivory black and burnt sienna are the colors which are the mainstay of artists. From these basic pigments can be produced every ordinary color effect in nature directly or by blending. But, in these days of rapid action, many or most artists add an

array of other paints to the color-box, care being taken that they are not such as fade quickly in the light, as do prussian blue, antwerp blue, etc. French ultramarine (pure ultramarine being altogether too expensive), Indian ink, rose madder, sepia, oxide of chromium, vermilion and naples yellow are considered safe for use. Brushes are peculiarly a matter of choice of individual artists, their sense of touch differing greatly. The number selected is not so much a matter of importance as their being kept *absolutely* clean and carefully dried after use.

But the full capacity of the water-color medium was not known before the pictures of Joseph Mallard William Turner (1775–1851) (an early student of John Cozens' works and a constant coworker with Girtin till the latter's premature death), were exhibited to the world. His early water-colors were, indeed, low in tone and gloomy, though forcible and convincing. What he came to do in the way of color is shown best in his Venetian studies, originally made on the spot in water-colors. Turner, however, did not confine himself to the water wash; when he thought it necessary he employed body color in parts of his work, and even, on occasion, pastels; or it may be pencil or pen. But he never revealed to anyone the secrets of a technique which made him the greatest landscape painter in water-colors which the world has ever seen. The foundation of the Old Water-Color Society, in 1800, and of the new society, in 1863, gave a great impulse to the art, among whose representatives may be mentioned Copley Fielding (d. 1855); Peter de Wint (d. 1849); Samuel Prout (d. 1852), the master of architectural painting; David Cox (d. 1859) and the brilliant executer of Oriental genre, Lewis (d. 1876). Taylor and Landseer, as animal painters, found this a successful and pliant medium, and among the Pre-Raphaelites who were eminent aquarellists may be mentioned Rosetti, Madox Brown, Burne-Jones, Holman Hunt and Millais.

Prominent Aquarellists.—A partial list of the aquarelle artists of the English school whose works are appreciated by connoisseurs at sales must include the following; there are, of course, a number of noted artists who use the water-color medium as a side issue for "studies" but do not specialize on aquarelles. Earliest masters: Alexander Cozens and his son John Robert, Girtin, Turner, De Wint, David Cox, J. S. Cotman, Copley Fielding, S. Prout, Devis, Hearne, Bonington, Rooker, the two Cleveleys, W. Payne and N. Pocock. Belonging to the latter half of the 19th century we have F. Walker, G. J. Pinwell, Sir John Gilbert, G. Cattermole, E. J. Gregory, M. Birket Foster, J. M. Swan. Recent artists: R. W. Allen, Mrs. Allingham, Wilfrid Ball, F. Brangwyn, Sir Alfred East, G. S. Elgood, W. R. Flint, A. Goodwin, A. Ingram, F. E. James, H. Marshall, E. Noble, A. Powell, A. Rackham, A. Wardle, Sir E. Waterlow, J. R. Weguelin, J. W. West, M. Fisher, M. Hale, Hughes-Stanton, Lamorna Birch, A. W. Rich, C. M. Gere, C. J. Holmes, etc.

In France, among able landscape painters in water colors, were conspicuous I. B. Isabey (1767–1855); Hubert, J. Ouvrié, Sué and Fort. They pretty generally employed body color (*gouache*) in their composition, the transparent wash being much less frequently employed in France. In portraits, Olivier Grand; in flower painting and still life, Redonté (1759–1840), the best painter of this class France has ever produced. But the art was not tried to its full capacity until the oriental sketches of Eugene Delacroix (1798–1863) proved to the French art world that there was something to be sought for fresher and more inspiring than the frigid classicalism of David. His lead was followed by Descamps (1803–60), one of the best colorists and most original painters of the modern French school, who taught his countrymen that it was possible to represent in water-colors the broad blaze of open sunlight in an African sand-plain; or in the streets of Smyrna and Constantinople. The powerful genres of Gavarni (1804–66) made a sensation even in England, the native home of water colors.

The German school of water-color painting began with the illuminating or tinting by hand of copper plate engravings. An independent and distinct department of aquarelle came late in the history of German art. The first notable aquarellists in that country were Karl Werner of Leipzig and Edward Hildebrandt of Berlin — Viermann, Otto, Grael of Berlin, Heindrich, Stöckles, R. Stieles of Munich and a circle in Düsseldorf, including Scheuren and Mintrop, kept up the traditions of German water-color painting. A new path was struck out by Menzel, who obtained a great following. He adopted a broad, frank and dashing style which was much admired. The Berlin painters, such as Franz Skarbina and Paul Mayerheim, vied with him in this method of handling. But German aquarelle has never been distinguished for the lightness of touch, the brilliant and transparent coloring, the powerful and vivid landscape effects which we find in the productions of English and French artists. Italy and Russia on the other hand have many skilful adepts in this art. The vivid coloring of such masters as Corelli, Zezzos and Mainella has a light and vividness all its own and the creations of these painters are worthy of comparison with many of the most eminent workers in their own department of art in other parts of Europe. The same may be said of the Russians, Benkendorf, Bergholz, Karafin, Heftler, Jegornow, Pissemski and Ehrenon.

Water-color painting has always formed a very living section of American art life. When Vassili Verestchagin, the great Russian war painter, was in America, he was astonished, according to his own account, that native artists were not more alive to the possibilities of American scenery and American life as subjects for the pencil. He was not sufficiently acquainted with the history of art in the country to which he had come a stranger, to be aware of the fact that local art had long flourished there. The Hudson River School of painters produced many noble transcripts from the scenery of that river, mostly in large canvases, and by employing oil as a favorite medium, but several of them have also executed gems of art in water-colors after the style of the best masters. Among those who have done some good water-color sketching among the sublime scenery of the West may be named Albert Bierstadt, some of whose views are correct in drawing and rich in coloring, albeit they owed their original impressiveness to the novelty of the effects in atmosphere and moun-

tain contour or coloring which they reproduced. The same in a less degree may be said of the drawings of F. E. Church. Neither of these painters was, however, as triumphant in water as in oil. The New York Water Color Club has done much to foster a revived interest in this most difficult yet most effective and delightful department of the painter's art and among the most successful of those who cultivate it may be enumerated James McNeill Whistler, John Singer Sargent, Childe Hassam, Abbey, Moran, Parton, Murphy, Parsons, Shurtleef, Tryon, etc. Louis C. Tiffany is a colorist of rare gifts and although his natural predilection leads him to the representation of still life, yet his water-color landscapes have a value of their own. Charles Sanderson is well known for his lovely water-color studies of the shores of Lake Michigan. At the end of the 19th century there was suddenly a new movement developed in this department, principally through the influence of John H. Twachtman, whose early death was a sad blow to the cause he had most at heart in his native country. In 1898 the Ten American Artists crystallized into a new school of painting in New York. As far as this movement was represented by Twachtman it stood for a distinct advance in water-color art. There can be no doubt that he reflected in the practice of his art the very best features of that style which in Europe was embodied in the work of Girtin, Cozens and Turner. Water-color painting in the United States numbers among its devotees many other great names. Homer D. Martin's few water-colors are of the highest value. Frederic Crownshield shows in his water-colors a noble sense of the form of hills and cliffs and the greater forms of the landscape, as well as of tree-form. Winslow Homer's many water-colors are about as important a contribution to American art as any other group of works. They are extremely vigorous and impressive, they sell at high prices and among lovers of modern painting there are certainly none more esteemed. Winslow Homer is essentially a "painter's painter" and no single artist in the whole group is more admired by his fellow-artists. John La Farge's water-colors are what have chiefly made his great reputation. There are hundreds of them in private collections in Boston, New York and neighboring towns and the show of the South Sea Island collection at the Paris Salon in 1898 or 1899 occupied a hall especially set aside for it and made a great sensation. There is nothing in modern art more rich in color than these La Farge drawings, which were produced during the years 1865 to 1895 chiefly; for from that time he became thoroughly absorbed in decorating work, glass and the like. The work of Robert F. Blum and that of Irving R. Wiles commands the admiration of their brother artists. Francis Hopkinson Smith was a master of loaded color, that which is mixed with white (the French *gouache*). There are women artists who excel in water-color work of each kind.

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CLEMENT W. COUMBE.

WATER CRESS, WINTER CRESS. See CRESS.

WATER CURE. See HYDROTHERAPY.

WATER DISTRICT. See DISTRICT.

WATER-DOG, a salamander. See MUD PUPPY.

WATER-FLEA. See CYPRIS; DAPHNIA.

WATER GAPS. See DELAWARE WATER GAP; STREAM PIRACY; TRELLISED DRAINAGE.

WATER-GAS, a mixture of gases produced by the action of steam on incandescent carbon. The carbon first decomposes the steam, forming hydrogen and carbon dioxide, and the latter gas then combines with more carbon to form the inflammable carbon monoxide. Thus water-gas may be considered economically a mixture of hydrogen and carbon monoxide with certain impurities. Its especial value as a fuel lies in the fact that 90 per cent of its volume is combustible, while the ordinary producer-gas is but 30 per cent combustion. Pure water-gas is non-luminous, but it is rendered luminous by mixing with it various gases obtained from petroleum, the luminous mixture being known as carbureted water-gas. Two chief methods are employed for the manufacture of water-gas for illuminating purposes. In the first of these, the Lowe process, the preparation of the pure gas and the carbureting are performed in one operation. The apparatus consists essentially of a generator, filled with anthracite or coke, in which the non-carbureted gas is produced; a carbureter, a circular chamber lined with fire-brick and filled with a checkerwork of the same material; and a superheater, a taller circular chamber similarly filled. By means of air-blasts and the producer-gas from the anthracite of the generator, the fire-bricks of the carbureter and the superheater are raised to a red heat, and then superheated steam is passed through the incandescent carbon. The product at this stage is known as "blue water-gas" and burns with a very hot, non-luminous flame. It is useful for many manufacturing purposes. To make it available for illuminating the water-gas formed is carried over into the carbureter, where it becomes mixed with the highly carbureted gases formed by the action of the heated bricks on mineral oil, which is introduced from above. This process is completed in the superheater, and the carbureted gas is then ready for purification process in which the

sulphureted hydrogen and carbon dioxide components are removed. In the Wilkinson process the operations of making the gas and carbureting are separate. In the United States carbureted water-gas has largely replaced coal-gas as an illuminant, partly because of its brighter light and partly because it can be more cheaply manufactured. Illuminating gas made from coal is often mixed with carbureted water-gas in order to increase its illuminating power. The chief objection to the use of water-gas as an illuminant is the highly poisonous nature of one of its largest constituents, carbon monoxide. By keeping the percentage of this constituent down to 16 per cent of the total volume, the mixture is not more dangerous to inhale than ordinary coal-gas. See GAS, NATURAL.

WATER GLASS, a substance which, when solid, resembles glass, but is slowly soluble in boiling water, although it remains unaffected by ordinary atmospheric changes. It consists of soluble silicates of potash or soda, or a mixture of both. The soda glass has the formula, $Na_2O.3SiO_2$. A substance of this kind was first discovered, so far as is known, by Van Helmont in 1640. In the 19th century Dr. Johann Fuchs of Munich did much to improve the mode of preparing and applying it. Water glass may be prepared in two ways, called wet and dry. The former method is used where the proportion of alkali may be so large as 50 per cent, in which case the sand and alkali may be simply boiled together. Where a water glass richer in silica is required the mode of preparation consists in breaking down and calcining flint nodules, the fragments or particles of which are then added to a solution of caustic potash or soda, whereupon the whole is exposed for a time to intense heat at 60 pounds pressure. Sand may be used instead of the flint. According to the product when prepared in this way is viscid, and may be used in this state or further diluted. In this method of manufacture the caustic soda or potash may be replaced by the carbonate or the sulphate. Potash water glass is more soluble than soda water glass, and if both metals be present a still more soluble glass, called double soluble glass, is obtained. Among the purposes to which water glass is applied are painting on glass, coating stone, wood and other materials to render them waterproof or fireproof, glazing scenery and paintings, etc. It is also used mixed with sand to make an artificial stone, and it forms an ingredient indispensable in the manufacture of fireproof cements, such as are used in joining firebricks in furnace construction. For this purpose it is commonly mixed with lime. One of the most valuable of its applications is in the fixing of wall-paintings, by spraying with the water glass. They are thus rendered more durable than in the ordinary process of fresco-painting.

WATER HAMMER, the name applied in the laboratory to a vessel partly filled with water, exhausted of air and hermetically sealed. When reversed or shaken, the water being unimpeded by air, strikes the sides with a sound like that of a metal striking against glass. In hydraulics the term is used to designate the sudden rise of pressure in a pipeline due to the check of flow of the liquid running in it — as by the sudden closing of a valve. The strain on the pipe and any motor connected openly with it is often very serious. The formulas which are used to calculate this strain are $\frac{pr}{t}$ = the circumferential stress in the pipe walls; and $\frac{pr}{2t}$ the longitudinal stress — where p represents the increase in pressure in pounds per square foot; r the radius of the pipe in feet; and t the thickness of the pipe in feet. The hydraulic ram (q.v.) operates by water hammer. The technics of water hammer is exhaustively discussed in Gibson, A. H., 'Water Hammer in Hydraulic Pipe Lines' (Manchester, England, 1908).

WATER-HEMLOCK, deadly poisonous plants (*Cicuta*) of the carrot family, known also by many other names, such as beaver-poison, spotted parsley, muskrat-weed and musquash-root, the latter names being borrowed from the muskrat, which inhabits such swamps as the *Cicuta* affects; and the odor of the roots of certain species of the latter also recalls the musk-scented rodent. *Cicuta maculata* is a tall biennial, reaching eight feet in height, with a rigid, hollow stem marked with purple lines, that grows in swamps and wet lands throughout the northeastern United States. The leaves are decompound, even three-pinnate, having coarsely serrate leaflets, with veins apparently ending in notches instead of at the points of the teeth, as in ordinary foliage. The flowers are very tiny and white, in decompound, terminal umbels, with unequal pedicels. The fruits are ovate-oblong, glabrous and slightly flattened laterally. The ribs are corky, the lateral ones being strongest. Spindle-shaped, tuberous roots cluster about the base of the stem, and are the cause of many deaths. They have an aromatic flavor and fleshy substance, and are frequently mistaken, especially by children, for the roots of sweet cicely, parsnips, artichokes, or even horse-radish, and are sometimes eaten for no particular reason except that they are fleshy and exposed by washouts, freezing or digging-operations. Even livestock are killed, not only by feeding on the tubers themselves but by drinking water poisoned by roots which have been crushed under the cattle's hoofs. The poisonous element in this *Cicuta* is an aromatic oily fluid, which permeates the whole plant, but is found chiefly in the roots, and probably contains the alkaloid conine and the bitter principle cicutoxin. When eaten *Cicuta* produces vomiting, colic, staggering and unconsciousness, and finally frightful convulsions which end in death. No chemical antidote being known, the only treatment possible is to cleanse thoroughly the digestive system, and treat each stage of the attack with such medicines as seem necessary. Cattle may sometimes be saved by timely and repeated doses of melted lard. The elongated spindling-roots of the Wyoming water-hemlock, *Cicuta occidentalis*, which in Montana is known as the wild parsnip, has a characteristic musky odor, and stock are poisoned either by the young plants or by the roots. Other species of *Cicuta* have a similar appearance above ground and are equally poisonous.

WATER-HEN, or **MOOR-HEN,** a rail (*Gallinula chloropus*), generally distributed throughout Europe, Asia and Africa. Its length is about 13 inches; back, wings, rump and tail rich dark olive-brown; head, neck, breast and sides dark slate gray; thighs and flanks streaked with white, belly and vent grayish white; beak yellowish, becoming red; naked patch on forehead red; legs and toes greenish-yellow, claws dark-brown. The female is rather larger and more vividly colored than the male. They frequent ponds covered with aquatic herbage, overgrown water-courses and the banks of slow rivers, swimming and diving with facility, assisted by an expansion of the membrane along the sides of the toes. The water-hen is representative of the sub-family *Gallinulinæ* of the rail family (*Rallidæ*) which comprises 30 or 40 species found in all parts of the world. In the United States they are generally known as gallinules or mud-hens, and are represented by the purple gallinule (*Ionornis martinica*) and the Florida, or common gallinule (*Gallinula galeata*). The American coot (*Fulica americana*) is also frequently called a water-hen.

WATER-HICKORY. See HICKORY.

WATER INCH, *in hydraulics,* a measure of water equal to the quantity discharged in the 24 hours through a circular opening of one inch diameter leading from a reservoir under the least pressure, that is, when the water is only so high as to cover the orifice. This quantity is about 500 cubic feet. In irrigation, the term is used synonymously with "miner's inch," which is the volume of water which flows in one hour through an aperture one inch square, the sides being horizontal and vertical, under a head of six inches measured from the upper edge of the aperture. The flow amounts to 673.2 gallons per hour.

WATER LAWS, the body of legislative enactment and legal decisions governing the rights to the use of water. In comparison with the laws concerning ownership of land and of other property the water laws, particularly in the United States, are extremely complicated. There is a great amount of law with apparent lack of consistency in the prevailing legislation and decisions. The cause of this lies largely in the physical fact that water as a substance varies in quantity from day to day and until recent years the principles governing its occurrence and the methods of measurements have not been well understood. In fact they are still more or less of a mystery to many members of law-making bodies. More than this there has been an attempt to apply rules of law which while suitable for permanent or fixed objects are hardly applicable to a substance the component particles of which are ever flowing away and are ever renewed, but in fluctuating quantity. To illustrate some of the different conditions and viewpoints take first the case of a natural spring or pond on a certain tract of land. It is generally conceded that ownership of the land carries with it the full right to the use of this small body of water. If, however, the spring or pond discharges onto a piece of land belonging to another proprietor, it is obvious that the second owner has certain rights due to the fact that the stream flows along or across his land. Under ordinary conditions the upper owner may not deprive the lower of his fair share of the water, at least for drinking purposes for man and beast. The stream flows on continually, joins with others and becomes a boundary line between proprietors. Each through his ownership of the land claims certain riparian rights in the flowing water. The stream finally becomes of such size as to be of importance to the whole community or State and the latter sometimes claims proprietorship in the bed and banks, these being held by the State for the benefit of the public. It finally becomes of navigable capacity, and, under the terms of the prevailing interpretation of the Constitution of the United States regarding commerce, the control is vested in Congress. In the older part of the country where, under humid conditions, there is usually ample water and to spare, the rule is that each riparian proprietor shall permit the stream to flow through or along his land undisturbed in quantity and unchanged or unpolluted as to quality — his rights being bounded by those of all his neighbors above and below, each having a fair share in the use of the water provided he does not interfere with rights of others. He may utilize the water for power if in so doing he does not overflow the lands of others nor interfere with established usages nor with the enjoyment of similar opportunities by others. If, however, a municipality finds it necessary to take water from a stream, it must be prepared to make compensation for any possible rights which may be interfered with. As a rule it cannot exercise the right of eminent domain outside of the borders of the State in which the city is located. It may be thus narrowly circumscribed and hindered from its best growth because of artificial restrictions imposed by State lines.

In the arid and semi-arid regions in the western part of the United States the common law of England, which has been followed in the humid East, is not in accord with the common necessities of the people. There it is possible to cultivate the ground successfully only through the artificial application of water. The lands will remain unproductive and population cannot increase unless the waters are taken from their natural channels to be spread over the ground and the stream channels left practically dry. The rights of riparian proprietors can be no longer observed, as in Eastern States, where under ordinary circumstances there is enough water for all. Out of the necessity of the people has thus grown an entirely different theory, namely, that of appropriation — this being limited to beneficial use, each appropriator being permitted to take usually only so much water as is needed for the irrigation of his land; even in this he may be required to show an economic use. In the case of two or more appropriators not finding enough water to satisfy their needs, the rule is usually enforced to the effect that first in time is first in right, although this rule is being modified in practice in accordance with larger equity, for example, if the first in time is at a place where there results great waste in getting

the water to him, consideration may be taken of the fact that to irrigate one acre thus situated many acres better located must be left dry.

The common law of riparian rights such as prevails in the eastern or humid part of the United States, but modified to a considerable extent, is recognized in California, Kansas, Montana and Washington. The civil-law doctrine declaring that the waters are the property of the State is contained in the constitution of Wyoming; similar declarations are made in the laws of Idaho, Nevada and Texas. By the constitution of Colorado the water of every natural stream is declared to be the property of the public and dedicated to the use of the people of the State. Similar declarations are contained in the water laws of Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota and Utah. Under the so-called Wyoming system the water rights are in theory acquired by grant from the State. There is great difference among the Western States with reference to the control of appropriation. In some States this control is vested in a State board with right of appeal, however, to the courts. In others adjudication proceedings are initiated in the courts. Because of the difficulty of ascertaining the ordinary supply of water and because of the exaggerated claims which are made to its use there have arisen innumerable controversies so that in some parts of the arid region more money is being expended in litigation than in actual irrigation. In most States in which water rights are adjudicated by courts the law provides that all parties claiming rights to water from the same source shall be made parties to the action so that all rights may be determined in a single action. Without such provision, there may be an interminable succession of suits, A bringing B into court to determine their respective rights, then C coming in and upsetting the arrangements and so on through the entire alphabet. The interest of the public or of the State is not necessarily taken into consideration at any time.

There are conflicting theories which arise from a difference of opinion as to the origin of rights to water. Throughout a greater part of the East there is insistence upon the conception that all rights to the use of water abide in and are derived from private or personal proprietorship of land and that any attempt at the invasion of the sanctity of property will result disastrously. Nevertheless attempts have been made and are continually being made to preserve the rights of the public and by asserting the theory of State ownership and control of water, to set a limit to the broad claims of riparian owners. Farther than this there is still a third class who claim that the Federal government has the right and duty on behalf of all the people and for the general welfare to extend its authority beyond the narrow limitations of preventing interference with navigation and to legislate in such a way as to prevent this great natural resource from being exploited wholly for private gain, especially as to those waters which have not already been appropriated or put to beneficial use. There is continual attempt of riparian owners and of large moneyed interests to extend and strengthen their control of water rights. At the same time efforts are being made by the State legislatures and by the Federal Congress to enact legislation protecting the general public in the proper enjoyment of water, which, like air, is essential to all life whether human, animal or vegetable. The conflict between these opposing theories and views is resulting in innumerable statutes and court decisions, many of them apparently irreconcilable. The unfortunate feature is that, besides provoking litigation, the largest and best uses of the waters of the country are not being given full consideration.

F. H. Newell.

WATER-LILY, a plant of the aquatic family *Nymphæaceæ*, especially of the genera *Castalia* and *Nymphæa*. These are found in fresh, still waters throughout the warm and temperate regions, and are often cultivated. Some can be easily raised from seed, and those which are hardy in the North will stand a very low temperature without damage, even to be encased in ice. They may be grown in tanks, or even in half-barrels, as well as in ponds; but the tropical species, such as *Victoria regia*, require the warmth of a greenhouse, or heated tanks, in our northern latitudes. The water-lilies are handsome plants, having more or less orbicular, generally peltrate leaves, either floating or, more rarely, immersed, and solitary flowers, of similar varying habit. These blossoms have several sepals and many petals, stamens and carpels, the latter distinct, united or immersed in a thickened receptacle; in color they may be white, pink, yellow or blue, and are sometimes very fragrant. The fruit is indehiscent, somewhat fleshy, and like a giant berry filled with nuts, or, in the case of *Nelumbo*, the nuts are half sunk in pits in the flat-topped, enlarged torus. The seeds are large with fleshy cotyledons and are naked or enclosely in pulpy arils. Water-lilies, even in the time of Pliny, were considered to be an antidote to love-philtres. The most famous of them is perhaps the giant or royal lily, *Victoria regia* (q.v.) Another which is very large is the Austrian water-lily (*Castalia gigantea*), which is one of the finest of its genus. Its flowers are sometimes a foot across, with hundreds of stamens, and the color is blue, or even other tints. They do not close so completely at night as do other water-lilies. The Egyptian lotus (*Castalia lotus*) that was a favorite plant of the ancient Egyptians is often confounded with the Indian lotus (*Nelumbo*), but is really a blue flowered water-lily. It was a valuable plant to the decorators of that country, who copied it, and conventionalized its form in many of their architectural ornaments, and also introduced it constantly into their painted pictures of life and customs. Its rootstock and seeds served as a food. (See Lotus). The European water-lily (*Castalia alba*) is similar, but has white flowers that are apt to open a little above the surface of the water, being supported on a stiff petiole. The flowers are not fragrant, as are those of the American pond-lily (*Castalia odorata*). The latter lovely lily rides upon the water, with creamy-white petals radiating in circles, the inner gradually narrowing, and passing by various stages into golden stamens

in the centre. They expand in sunshine and close in the early afternoon. The fruit is ovate and baccate and ripens under water. The leaves, or lily-pads, a favorite food of deer, are ovate-orbicular, with a deep sinus, and have very long cylindrical stems of unvarying thickness, great flexibility and toughness. The thick, fleshy creeping rootstock furnished a brown dye for the early settlers, and was also used as a styptic and tonic. A variety of this lily is smaller and has rose-colored flowers. There are several other species of Castalia in the United States, including the handsome golden-flowered lily (*C. flava*) of Florida.

One of the most common water-lilies is the yellow pond-lily (*Nymphæa advena*) which blooms all through the summer, but is not very beautiful. The leaves are ovate, or orbicular, with a deep sinus at the cordate base. They may be either floating or erect, especially when the plant grows in tidal streams, and is likely to be left standing nearly out of water, upon the ebbing of the tide. These pond-lilies also are known as spatter-docks and frequently join with pickerel-weeds in obstructing a boat's passage to the shore, along which they stand in an extended ribbon. The flowers are flattened globes, made up of half a dozen thick, golden sepals, arching over the stamen-like sepals. The fruit is ovoid, somewhat constricted at the neck and contains edible seeds. The strong-growing Pacific Coast representative of the spatter-dock is the *Nymphæ polysepala*, known to the Klamath Indians as *wokas*. It is very like the Eastern species. When fully mature, the large pods burst open irregularly at the base, and the entering water, when it reaches the white, mealy interior in which the seeds are imbedded, at once starts a mucilaginous dissolution of it, which frees the seeds and allows them to sink into the water. These seeds were once a staple farinaceous food of the Klamath Indians, and are still a favorite delicacy among them. The squaws betake themselves in canoes to the lily-patches and pluck the full-grown pods while still hard, or scoop out those already dissolving with a wicker spoon. The latter are the more prized, and are deposited in holes in the ground, where the pods ferment and turn into a mucilaginous mass from which the seeds may be freed by washing. Or the seeds may be extracted by other methods. They are then prepared in various ways for eating, either as mush or meal, or merely parched; they are delicious cooked in this manner.

Nelumbo nelumbo is the Indian lotus; *Nelumbo lutea* is the American or yellow lotus of the Middle West. It is also called water-chinquapin, on account of its edible seeds. Consult standard authorities, especially Bailey, 'Standard Cyclopedia of Horticulture' (New York 1916).

WATER-LOCUST, or **SWAMP LOCUST** (*Gleditschia aquatica*), a variety of honey-locust indigenous to the Southern States. See Locust.

WATER MARK, (1) The mark or limit of the rise of a flood or the mark indicating the rise and fall of the tide. (2) In paper-making, any distinguishing device or devices appearing in translucent lines in the substance of a sheet of paper. It is produced by a pattern of wire built upon the web and receiving heavy pressure from the rolls as the film of pulp passes through them while yet in a damp or pulpy condition. The water marks used by the earlier paper-makers have given names to several of the present standard sizes of paper, as foolscap, crown, elephant.

WATER METER, a mechanism by which the quantity of water or any other liquid flowing through pipes is measured and recorded automatically. They are of three general types — the "positive," the "inferential" and the "proportional" meters.

Positive meters measure the actual volume of the water, by the action of a piston working in a cylinder which is successively emptied and filled at the completion of each stroke. The cylinder being of known dimensions affords a measure of the quantity of water introduced. The pistons are either reciprocating or rotary, or of the oscillating or gyrating disc patterns and they may be single or double. When single, a weight or spring produces the return stroke, but in the case of the double arrangement, the reciprocal action of the two pistons is controlled by the action of each other, as in the case of a duplex pump. In rotary piston meters, which may also be of the single or double type, the pistons have interlocking faces and rotate in an air-tight chamber. Upon the outer surfaces of the pistons are a series of projections and recesses which correspond to similar shapes on the inner walls of the cylinder. The pressure of the flowing water causes the piston to turn so that a series of recesses or chambers in the cylinder are successively filled and discharged from the inlet to the outlet of the meter. When oscillating or gyrating discs are employed in the place of pistons, the wabbling motion of the discs alternately empties and fills the cylinder. Inferential meters measure the velocity of the flowing water by recording the revolutions of a turbine or other water-wheel attachment, and the quantity is deduced by computation from that record. Proportional meters measure a fractional part of the full flow and are, therefore, capable of being set on a small by-pass pipe which branches from and subsequently rejoins the main pipe, but being only approximately accurate their use is limited.

The registering mechanisms consist of a series of gear-wheels and dials. The flow of the water actuates the gear-wheels, and the number of revolutions are recorded on the dials. The arrangement of the mechanism converts the number of revolutions into any desired unit of volume, so that the reading of the dials is termed straight and gives the quantity direct, in cubic feet, the unit generally adopted, particularly in the United States.

The working parts of meters are made light and durable. Serviceability and accuracy are the qualities required, and in their design the support of the water pressure is employed to reduce to a minimum the loss of head, and the wear and tear of the working parts, and although a high degree of accuracy is not generally required, the meters are made sufficiently sensitive to measure the small flows incident to leakage. Hard rubber is generally used for the discs, and also for the rotary pistons of some meters, but where the liquids are hot, or consist of chemical solutions, brass is generally

employed. Possible damage due to clogging by the introduction of fish or gravel is prevented by various forms of strainers and sieves, while effect of frost is guarded against by frost cases.

There are several forms of meters which do not come under the general classes already described. Of these the "Venturi," constructed by Clemens Herschel of New York, in 1886, is the superior and most useful on account of its simplicity and durability. Its basic principles — the relation between the reduction of pressure and the increase of velocity of water flowing through a contracted pipe, was discovered by Venturi in 1796. In construction it consists of two conical shaped pipes with their smaller ends joined together by a collar or throat-piece, resulting in a shape similar to a pipe contracted at one point of its length. By gauging the pressure of the water at a point just before, and also directly at the point of contraction, and the relation of these pressures to the diameter of the pipe, the volume of the flow is computed. The tubes are usually constructed of cast iron or riveted steel; but they may also be constructed of masonry or wood. The length of the meter varies from 8 to 16 times the diameter of the uncontracted portion, while the diameter of the contraction ranges from one-fourth to one-half of the full diameter of the tube. They are made in sizes varying from two to about 100 inches, with practically no limit to the possible maximum size, but for practical use where meters of diameters less than six inches are required those with moving parts are cheaper. Waste-water meters are employed in connection with waterworks to measure the rate of consumption per unit of time, instead of the total volume. They consist usually of a disc placed horizontally in a cone-shaped chamber. The disc is lifted or lowered according to the greater or lesser volume of water passing through the pipe in which it is set, and being connected by a wire with counterweight and pencil which follow the movements of the disc, records the nature and amount of those movements on a paper carried by a drum which is revolved by clockwork. The vertical rulings of the record sheet indicate the time intervals, while the horizontal lines represents the units of volume. Since all the water consumed in a given district must pass through such a meter, by comparing the rates of consumption of the various districts, the causes of abnormal waste are readily determined and localized.

Another form of water meters, more particularly known as current meters, are employed in hydraulic engineering to measure the velocity and volume of flow of the waters in rivers, large aqueducts and sewers. See CURRENT METER.

WATER-MOCCASIN, a snake. See MOCCASIN.

WATER-MOLDS. See FUNGI.

WATER MOTOR. In its broadest sense the term is applicable to all forms of machines or systems of machinery operated by water under the force of gravity, or in other words, by which the energy inherent in a natural waterfall is utilized to perform mechanical work. There are three types of such motors, classified as (1) gravity motors; (2) pressure motors, and (3) impulse motors. Of these machines, the water-wheel (q.v.), the turbine (q.v.) and the pump (q.v.) have been treated under their respective titles, but in this article the term will be considered as designating those machines which are operated by the element of pressure only, such as hydraulic lifts and water pressure engines.

The Hydraulic Lift, used in elevator service, is the simplest of all water motors. The direct-acting lift consists of a cylinder in which a ram or piston of equal length, with a cage attached to its upper end, works up and down. The level of the water supply must be necessarily above that of the maximum height through which the cage may be lifted, so that when the water is admitted to the cylinder at its lower end, the pressure forces the ram upward and thus lifts the cage. The descent of the ram is accomplished by closing the supply valve and opening the discharge valve, the ram descending by its own weight. As the weight of the ram is greater than necessary to bring down the cage, a part of that weight is balanced by a counterweight attached to the end of a chain that works over a pulley at the top of the lift and is connected to the cage. The most familiar examples are the high-speed hydraulic passenger elevators. They are operated by the pressure of water pumped into tanks situated on the roofs of the buildings in which they are installed, while the operating machinery is located in the basement. (See ELEVATORS). The hydraulic press and the hydraulic ram are devices operated practically under similar principles. In the former, the action depends upon the principle of hydrostatics that a pressure applied to any part of the surface of a liquid is transmitted in all directions and throughout the mass without diminution. For example, if a cylinder filled with water has a plunger one inch square working through one end and another 10 inches square working through the other end, and a pressure of one pound is exerted on the smaller plunger, this pressure will be transmitted to the larger plunger and be delivered by the latter in a multiplied amount equal to the square of its face area expressed in pounds. In this example that pressure would be 100 pounds. Such presses consist essentially of two cylinders connected by piping. The pressure is applied to the plunger of the smaller cylinder and the multiplied pressure is transmitted by that of the larger to the object to be raised or pressed. In construction they vary greatly with the purpose for which they are employed. Those used as hay, cotton and oil presses consist of four strong iron pillars arranged in the form of a square, which carry a cast-iron plate solidly attached to their tops. A similar casting is situated at the bottom of the pillars. Through a circular hole in the centre of the lower plate, a plunger carrying a square platen on its head works with an upward motion and presses the material placed between the platen and the under face of the top plate. In presses used for hydraulic forging, the cylinder and plunger are carried by the top plate, while the bottom plate carries the anvil. The plungers work downward in the act of pressing or hammering. They are made of various sizes and are generally provided with two pressure plungers and cylinders and they are adapted for purposes varying from the manufacture of revolver cartridge cases to the

forging of armor plate, guns and steamship shafts. Armor plate presses capable of exerting a pressure of 14,000 tons are in use, while 7,000-ton fluid compressors are employed in many of the larger steel manufacturing plants. A brief description of the construction and working of one of the last-named capacity will serve to illustrate the mammoth proportions and enormous power of these machines. It consists of an upper head weighing 120 tons carrying the plunger and a 135-ton base plate containing the hydraulic cylinder. These are supported and held in place by four vertical connecting columns each 50 feet long, and 19 inches in diameter. In operation, the molten metal is poured into a mold built up in sections and the mold is raised under a hydraulic pressure of 7,000 tons, while a plunger attached to the upper head bears down upon the fluid metal and compresses it.

Hydraulic Ram.— In the hydraulic ram the force of water flowing by gravity is utilized to raise a portion of its volume to a height above that of the source of supply. Two pipes are employed. The water in flowing through the main or drive pipe acquires sufficient momentum to close a valve at the foot of the pipe, and the water thus confined automatically opens another valve, partially fills an air chamber situated over the foot of the main pipe and compresses the air in it until the pressure within balances the column of water in the main pipe. Then the foot valve of the main pipe opens again and the action described is repeated. In the meantime, the pressure in the air chamber forces the water through a small service pipe leading out of its bottom, to the required height. See HYDROSTATIC PRESS; HYDRAULIC RAM; POWER TRANSMISSION; PUMPS AND PUMPING MACHINERY.

Hydraulic Engines.— In the hydraulic lifts or elevators, the admission and discharge valves are worked by hand at the will of the operator, but in the engines the mechanism actuates the valves automatically and periodically, thus converting the lift into a machine with a continuous action. Unlike the vertical water wheels and turbines, the efficiency of which depends upon the weight of a large body of water falling from a comparatively small height, the water engines work under the pressure of a small column of water descending from a considerable elevation. They are of three types — the "single action," in which a piston working in a cylinder is moved upward by the pressure of the water, and downward by the weight of the piston itself; the "double action," in which the cylinder is closed at the top as well as at the bottom, and the water admitted to it by supply pipes at those points, acts reciprocally on the piston from above and below; and the "rotary," in which the water pressure acts on a revolving piston similar to that of a rotary steam-engine. Rotary engines may be of the single-acting or double-acting type, the advantage being with the former, since the pressure of the piston is always exerted on the crank pin in one direction and the dead centres are passed without knocking. Generally three single-acting cylinders formed in one casting are used in connection with a disc valve with segmental ports which pass over corresponding apertures in the valve seating, during rotation and the engine will readily start in all positions. The first engine of this kind was constructed by Sir William Armstrong, who also subsequently designed one of the reciprocating pattern. Since then a great variety of hydraulic engines have been invented, the greater number of them being of the last-named type. (See HYDRAULIC ENGINE). They have a wide field of usefulness, especially as auxiliary motors for driving small machinery such as hoists, swing-bridges, capstans, cranes, winches, etc. The employment of superheated water motors is one of the latest developments in the methods for railroad traction. In the earlier forms of engines operated by superheated water, the storage tank being charged with water at a temperature corresponding to several hundred pounds of pressure, only the steam from the water was utilized in the cylinders of the motor, in a manner similar to the utilization of steam from the boiler of a locomotive engine by expansion in its cylinders. Their operation was based upon the relation of temperature and pressure to the vaporization of liquids and the steam was drawn off from its point of formation at the top of the storage tank to the cylinders. Under these conditions, with each revolution the new steam was supplied by water which boiled at continually lower and lower pressures and reduced temperatures, until the pressure fell to a point at which it was not available for use in the motor; and only about one-ninth of the energy of the heated water was actually used in the cylinders. W. E. Prall of Washington, D. C., suggested the utilization of the power in the storage tank by withdrawing the superheated water directly from the bottom of the tank instead of steam from the top and allowing the water thus withdrawn to expand into steam within the cylinders of the engine itself. In the latest motors, this is accomplished by a generator composed of a nest of tubes coupled into manifolds at the top and bottom. The working pressure is about 700 pounds to the square inch and the water is drawn off from the generator into three insulated storage tanks with a total capacity of 7,000 pounds, carried beneath the car. From the bottom of the tanks the water is delivered through three Tappet valves provided with screw and nut adjustment to regulate the amount of feed. In operation, under the decreasing pressure caused by the movement of the piston through its stroke, the water resolves into steam in a continuous series of flashes, the steam and the unevaporated portion of the water from the high-pressure cylinders passing out through the ports in its bottom and draining off through valves in the lower face of the valve chest. The exhaust steam from the high-pressure cylinder passes in the usual way to the low-pressure cylinder and is eventually exhausted into the atmosphere. A car equipped with two compound engines and three tanks charged with water at a pressure of 700 pounds to the square inch and a corresponding temperature of 500° is capable of running 40 miles at a speed of from 30 to 40 miles an hour.

Bibliography.— Church, I. P., 'Hydraulic Motors' (New York 1911); Gibson, A. H.,

'Hydraulics and Its Applications' (New York 1915); Innes, C. H., 'Centrifugal Pumps, Turbines and Water Motors' (Manchester, England, 1904).

WATER-OUZEL. See OUZEL.

WATER-PLANE. See WATERS, UNDERGROUND.

WATER-PLANTAIN, an aquatic or marsh herb of the genus *Alisma*, family *Alismaceæ*, of which *Sagittaria* (q.v.) is also a member. The plant most commonly known as water-plantain is that found also in Europe and Asia (*Alisma plantago aquatica*), which grows in mud or shallow water. It has a circle of radical long-petioled leaves, ribbed ovate and strongly resembling those of the common plantain. The scape, which is usually solitary, branches verticillately, and forms a large, open pyramidal, flowing panicle; the blossoms are very small, white or rose-colored and have their parts in threes.

WATER POWER. Water power is derived from the conversion of the energy of falling water into mechanical work. If a volume of water having a weight w in pounds is situated at a height h in feet above a plane of reference, it possesses a potential energy $w \times h$ in foot pounds, all of which can be converted into kinetic energy by allowing the water to fall through the height h. If the water in falling passes through a suitable hydraulic motor, most of its potential energy can be converted into useful mechanical work, in which case the water will reach the bottom of the fall with little or no energy remaining, instead of having its full energy remaining in kinetic form, as it would do if it fell freely and unrestricted. In practice, water power is usually derived from running streams, and the amount of power is expressed in terms of the rate at which energy is supplied to or derived from the hydraulic motor. The ratio of the rate at which energy is derived from an hydraulic motor to that at which it is supplied to the motor is called the "efficiency" of the motor. The amount of power may be expressed in terms of the rate at which energy is supplied, or the rate at which mechanical work can be performed by the motor. The former is called the "theoretical power" of the water or stream supplying the motor.

One horse power, as defined by Watt, represents energy sufficient to raise a weight of 33,000 pounds one foot high per minute, or in other words, 33,000 foot-pounds per minute, or 550 foot-pounds per second. Fresh water weighs 62.42 pounds per cubic foot, hence the theoretical horse power of a constant stream of water, flowing in a volume of q cubic feet per second, and falling through a height of h feet, is equivalent to

$$\frac{62.42 \times q \times h}{550} \text{ horse power.}$$

This reduces to the simple rule —
Theoretical horse power of water =

$$0.1135 \times q \times h.$$

The output or derived power of an hydraulic motor, or of a water power, is the product of the theoretical power multiplied by the efficiency expressed as a decimal, or if the efficiency is E, then the mechanical or brake horse power is equal to

$$0.1135 \times q \times h \times E.$$

Efficiency may be considered with reference to the hydraulic motor alone, or with reference to the entire power plant, including allowances for losses of power in electric generators and other equipment in the case of hydro-electric plants. If used in the latter sense it is termed "over-all efficiency," and the theoretical horse power, multiplied by the over-all efficiency, represents the net rate of power output by the plant or power development.

Water power ranks with mines and the soil as one of the greatest natural sources of wealth. Coal and oil supply at present the greater portion of the fuel and energy used in the world, but this supply is exhaustible. The soil fosters organic growth, which is capable of supplying energy resources chiefly in the forms of wood and of alcoholic fuels. These sources of energy, like water power, are perpetual, but are at present relatively much less important.

Machines or organisms through the operation of which useful mechanical work is derived from natural sources of energy are called "prime movers." There are organic or living prime movers which derive useful mechanical work from the latent energy contained in the food they eat. Men and horses are found to be relatively inefficient as prime movers. The human body is capable of yielding back through muscular work only about one-fifth of the available energy supplied to it as food. Another class of prime movers consumes fuel and converts its potential energy into kinetic energy by means of steam, gas and oil engines. Both the preceding classes may be considered as fuel engines. They derive energy from highly organized compounds which have originated in life processes. These are broken down into simpler compounds by the processes of digestion or combustion, and in accordance with a rule of nature, they give up a supply of stored energy as they are disintegrated. The supply of power from chemical reduction being dependent upon life processes, can be renewed by a perpetuation of life, but unfortunately fuel consumption at the present time greatly exceeds the rate of renewal, and we are mainly dependent on the great storehouse of latent energy given us as a legacy from past ages in the form of coal, oil and gas. The power consumption at the present day, if derived from wood alone, would exhaust our timber supply in a few years. In the early days of railroads, wood was used as fuel in locomotives. Few of us realize the extent to which the forests were devastated to supply that need.

Prime movers of another or third general class derive their energy more directly from the sun and operate by means of the winds, waves and tides. This class includes solar engines that concentrate and utilize the sun's heat directly. It also includes wind mills. Water wheels of all kinds belong to this general class. The source of their power is the sun's heat, operating through the hydrologic cycle of precipitation, evaporation and run off. Vapor evaporating from the seas and lands is condensed in the upper air, and falls again on the uplands as rain, running in streams and rivers down the hillsides and valleys to the lakes and seas, and again evaporated, is kept in a perpetual cycle of

change by the opposing forces of the energy of the sun's heat and the earth's gravity. It is the sun which supplies the power to overcome gravitation and lift the water to a height from which in falling it drives the water wheel.

runner. The hydraulic turbine is usually encased or submerged in a flume, and is often "out of sight, and out of mind," to the extent that it lubricates itself, and frequently does not receive or require direct attention for years of operation.

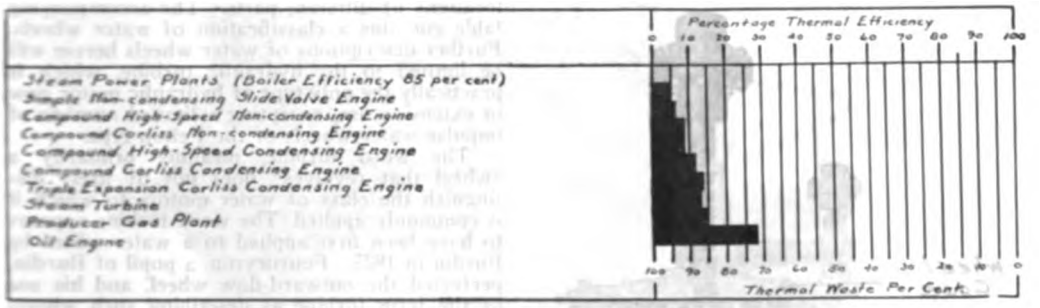

Percentage Thermal Efficiency
0 10 20 30 40 50 60 70 80 90 100
Steam Power Plants (Boiler Efficiency 85 per cent)
Simple Non-condensing Slide Valve Engine
Compound High-Speed Non-condensing Engine
Compound Corliss Non-condensing Engine
Compound High-Speed Condensing Engine
Compound Corliss Condensing Engine
Triple Expansion Corliss Condensing Engine
Steam Turbine
Producer Gas Plant
Oil Engine
100 90 80 70 60 50 40 30 20 10 0
Thermal Waste Per Cent.

FIG. 1.—Comparative Efficiencies of Fuel Motors.

The usual efficiencies of different types of fuel engines are shown graphically by Fig. 1. The average efficiency of fuel engines in use at the present time, of all kinds, including gasoline and steam engines, steam turbines and locomotives, is probably about 10 per cent.

A water-power development consists essentially of a turbine or water wheel with adequate means of supplying the water and regulating the supply. Types and methods of water-power development are so closely related to types of water wheels that it is necessary to give

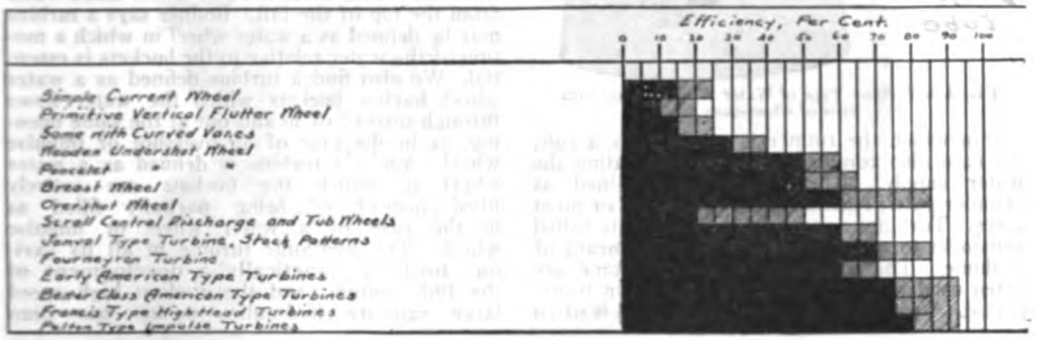

Efficiency, Per Cent.
0 10 20 30 40 50 60 70 80 90 100
Simple Current Wheel
Primitive Vertical Flutter Wheel
Same with Curved Vanes
Wooden Undershot Wheel
Pocelet " "
Breast Wheel
Overshot Wheel
Sagell Central Discharge and Tub Wheels
Jonval Type Turbine, Steel Patterns
Fourneyron Turbine
Early American Type Turbines
Better Class American Type Turbines
Francis Type High Head Turbines
Pelton Type Impulse Turbines

FIG. 2.—Comparative Efficiencies of Water Motors.

Fig. 2 shows the average efficiency (solid black) and the best efficiency (shaded) ordinarily obtained from various types of hydraulic motors. This diagram shows, for purposes of comparison, the efficiency of various early and obsolete types of water wheels, such as current, flutter and central discharge wheels. Even these were more efficient than the best fuel engines. At the present time practically all water wheels in use are of one or the other of the last three types shown on Fig. 2. These have efficiencies ranging from 70 to 93 per cent. The great efficiency of hydraulic turbines as compared with other prime movers is strikingly illustrated by the fact that if it were possible to replace all fuel engines now in use by some improved type, having an efficiency equal to that of the hydraulic turbine the effect would be the same as if the existing supply of coal in the world was increased at least seven times. Not only is a developed water power the most efficient means of converting natural energy into mechanical work, but the hydraulic turbine is the simplest of all prime movers. Such a water wheel usually contains only one continuously moving part—the

here some description of the latter. A water wheel is a hydraulic motor that operates continuously by rotation in the same direction. A canal lock lifting a boat is a water motor but is not a water wheel. A water wheel usually consists of various parts, of which the most important is the runner, or moving part. A runner is usually divided into various compartments into, or through which, the water flows. These compartments are properly called buckets. The word bucket is often used incorrectly to describe the vanes or partition walls which form part of the boundary of the bucket. It is better to describe the partition walls between adjacent buckets as vanes. It is often convenient to speak of the passage through or into which the water flows, and these passages are sometimes themselves called buckets, but may be more properly referred to as bucket passages. As stated above, the buckets are separated by vanes, which form the boundary walls on two sides of each bucket. The boundary walls on the remaining two sides are usually formed by the crowns. The compartments through which the water flows into the buckets are properly termed chutes or guide

chutes. The passage through a chute may be conveniently called a guide passage, and the partition walls between adjacent chutes are properly termed guide vanes. Usually a water wheel of the turbine type is enclosed in a case, of which the guide chutes form a part, and

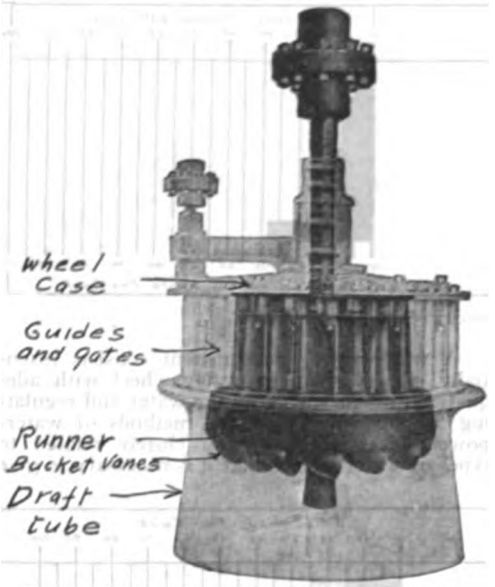


FIG. 3.—Turbine Type of Water Wheel. Phantom view of wheel-case.

within which the runner is placed. As a rule, the case also contains gates for regulating the water supply. These may be classified as cylinder gates, register gates and wicket or pivot gates. Turbines are set in compartments called penstocks to which the water is led by means of a flume. The words penstock and flume are often used with the meanings here given transposed. A penstock of sheet iron or steel is often spoken of as a case, but inasmuch as the wheel proper has a case which is placed inside the penstock, it is better to make the distinction of meaning given above.

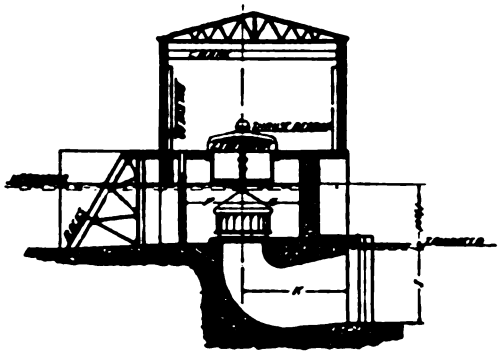
Fig. 3 shows a phantom view of a modern hydraulic turbine, giving the names and relative locations of different parts. The accompanying table contains a classification of water wheels. Further descriptions of water wheels herein will be limited to the hydraulic turbine, which is practically the only type of hydraulic motor now in extensive use, excepting a limited number of impulse water wheels of the Pelton type.

The word turbine, meaning primarily a "wheel that revolves" does not of itself distinguish the class of water motors to which it is commonly applied. The word turbine appears to have been first applied to a water wheel by Burdin in 1825. Fourneyron, a pupil of Burdin, perfected the outward-flow wheel, and his use of the term turbine as describing such wheels led to its general adoption to distinguish water wheels operating by combined action and receiving their water supply to all the buckets simultaneously. We find the word turbine variously defined by different authors. Weisbach includes impulse wheels in the class of turbines. Bjorling distinguishes a turbine from a water wheel in that it takes its water supply at the centre or bottom of the fall, while a water wheel takes water from the top of the fall. Bodner says a turbine may be defined as a water wheel in which a motion of the water relative to the buckets is essential. We also find a turbine defined as a water wheel having buckets which the water flows through instead of in and out at the same opening, as in the case of an overshot or impulse wheel. Again a turbine is defined as a water wheel in which the buckets are entirely filled instead of being partially filled as in the case of a water wheel or impulse wheel. The hydraulic turbine in all its various forms is practically a development of the 19th century, and the modern high speed large capacity hydraulic turbine has been

CLASSIFICATION OF ROTARY HYDRAULIC MOTORS

MODE OF RECEIVING WATER ON RUNNER	Place of receiving water on runner	Action of water at full capacity	General direction of flow in wheel relative to runner	Usual designation of water wheel	
At one or more points on circumference but not usually on entire circumference.	Near summit of runner on horizontal axis.	Gravity	Circumferentially downward.	Overshot and pitchback	
	About mid-height of runner on horizontal axis.	Mainly gravity.	Circumferentially downward.	Breast and "Ten O'clock"	
	Below mid-height of runner on horizontal axis.	Mainly impulse.	Circumferentially downward.	Low breast	
	Near bottom of runner on horizontal axis.	Impulse	Tangential	Poncelet	
				Undershot	
				Hurdy-gurdy	
				Current wheel	
	Tangential to runner on vertical axis.	Impulse	Tangential	Flutter wheel	
			Partially reversing.	Rouet volante	
				Rouet curves	
	Tangential to runner on vertical axis.	Impulse	Tangential completely reversing	Modern Impulse Wheels	Pelton, Hug, Doble, etc.
Usually on entire circumference of inlet surface of runner, which may be on vertical or horizontal axis.	Inner end of buckets ...	[illegible] action.	Outward	Turbines	Barker Mill
	Inner circumference of runner.	Combined action.	Outward		Fourneyron
	Upper surface of runner	Combined action.	Downward		Jonval
	Outer circumference of runner	Combined action	Circumferential and inward		Scroll central discharge
			Inward.		Howd, Francis
			Inward and downward		American type

Fig. 5 illustrates various modes of setting hydraulic turbines in power plants. Fig. 5-*a* shows a vertical turbine in an open concrete flume. This mode of setting is most generally used for relatively low head developments. The wheel compartment is often spiral in form. Fig. 5-*b* shows horizontal turbines in an open rectangular flume. In Fig. 5-*b* there are two turbines or runners combined in a single unit, discharging into a common compartment between them, called the draft chest. The size of a turbine of a given capacity generally varies somewhat inversely as the speed of the turbine. By the use of two runners forming a single unit, as in Fig. 5-*b*, the capacity of the power unit is doubled without decreasing the speed, or in other words, a given power is obtained at a much higher speed than would result from the use of the single turbine runner of equal capacity. Fig. 5-*c* shows a vertical turbine with a closed spiral concrete penstock. This type is often used for medium heads. Fig. 5-*d* shows a horizontal turbine, with a spiral supply chute combined with the turbine case. This type is most commonly used for high head power developments.



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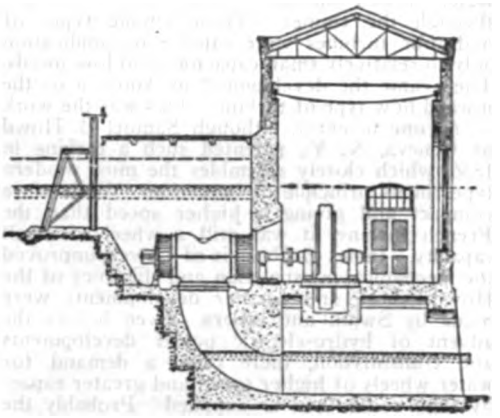

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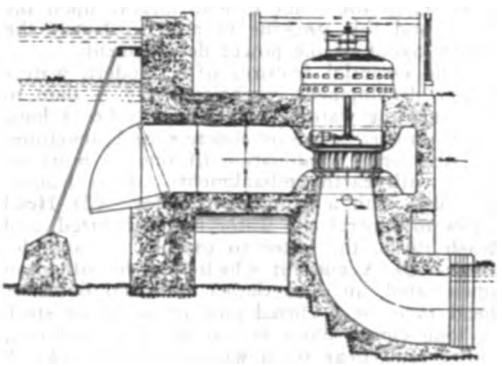
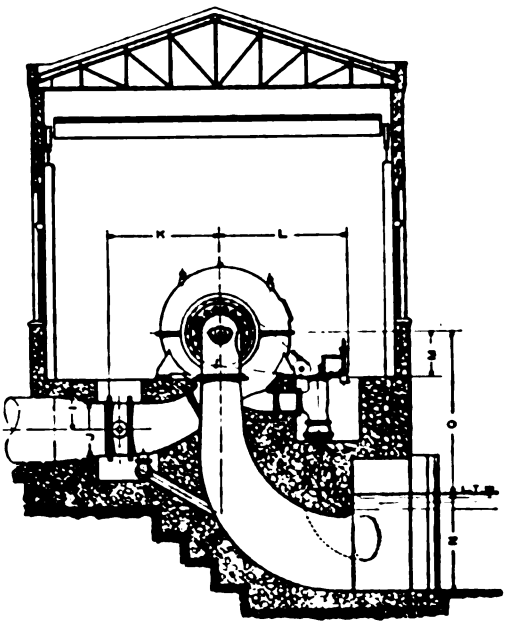


c



d

FIG. 5.— Usual Arrangements of Power Houses and Hydraulic Turbines.

A sufficiently concentrated fall for power development may occur in a stream naturally, or it may be created artificially. Fall is obtained artificially by (1) a dam, or (2) a canal or conduit, or (3) by both combined. Where a dam is built the fall which naturally occurred in the stream from the dam up to the head of the pond which it forms is concentrated at the dam, and the stream instead of wasting its energy in eddies and swirls and friction on the rough stream bed, flows smoothly and slowly through the pond to the dam with very little loss of power by friction. In a cascade development, the power plant is located immediately downstream from the dam or natural fall. Where a canal is used to concentrate the fall it is usually made uniform and smooth as possible with just enough grade to convey the required volume of water to the power house slowly and smoothly. The stream having a much steeper grade than the canal, the difference of level in the canal and stream, or, in other words the head, progressively increases proceeding downstream. Where the water is conveyed from the dam to the power house through a closed conduit, the principle is the same as where a canal is used,

for although the conduit may lie down near stream level, the water would rise in a vertical open pipe, connected to the conduit at any point, to a height nearly equal to the level at the entrance to the conduit. The difference between the height of the water at the source and the height to which it would rise in such a pipe is the head lost by friction in the conduit. In the earlier days of water-power development in the United States it was considered impracticable to utilize a head of more than about 30 feet on a single turbine. Accordingly, where the fall in a stream was greater than this at a given location, the total fall was subdivided between different canals, and the water drawn from the uppermost level supplied turbines which discharged into the second or next lower level, etc. This type of canal development was successfully utilized at Holyoke, Mass., Cohoes, N. Y., and elsewhere, but it often happened that mills on lower levels did not require the full quantity of water discharged from the upper levels, and a large waste would occur. One of the results which is being brought about by modern advanced methods of power development is the substitution of single hydro-electric stations for such canal systems, thus conserving a considerable portion of the available power.

Turbines are usually set at some height, never more than 25 feet, above the bottom of the fall from which they derive their power. The utilization of the power of the water in falling through a height equal to the distance from the centre of the turbine down to the level of the tailrace is effected by means of the draft tube. The water in falling through the draft tube creates a suction head, which increases the pressure or power of the water operating the turbine exactly as if the turbine were placed at the foot of the fall, thus rendering the full use of the head practicable. Placing the turbine above the tail water has many advantages; among others electrical generators can be directly connected to horizontal turbines so placed without danger of being flooded during high water. Theory requires that in order to utilize the power of a stream of water to the fullest degree, the water must be discharged back into the stream after its use, with the least possible velocity. It is never possible to discharge the water from a turbine wholly without velocity. The velocity of discharge can be much further reduced by passing the water through a gradually expanding draft tube after it leaves the turbine. The velocity of the water entering the draft tube is mostly converted back into draft head, which in turn increases the effective head and power of the turbine.

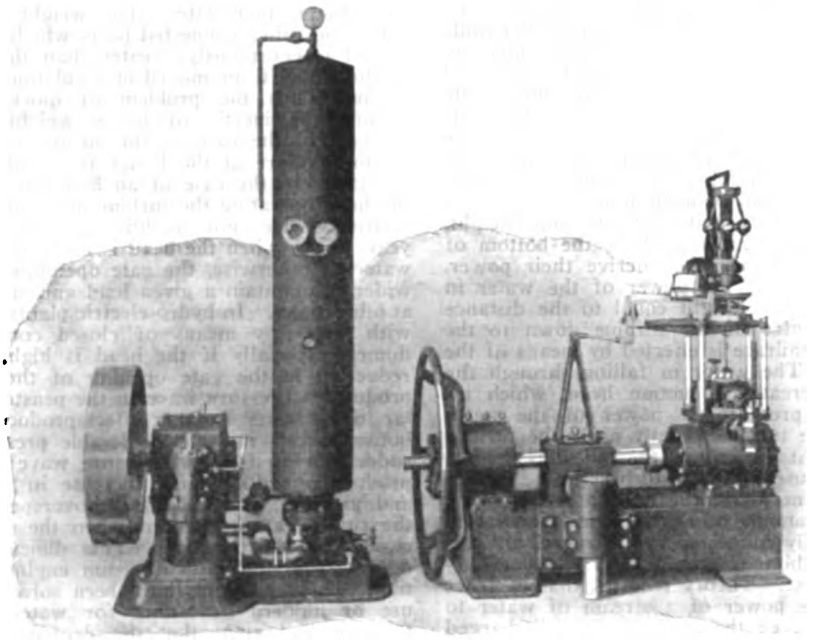
One of the most difficult and at the same time the most important factors in successful water power development for the purpose of generating electricity is the matter of speed regulation.

In many hydro-electric plants, sudden and large changes in load on the hydraulic turbine, or in the amount of power required, take place. To generate electricity for commercial use, the voltage of the current must remain practically constant. In order that this shall be the case, the speed at which the generator is driven by the hydraulic turbine must be regulated and maintained as nearly constant as possible. If the gates regulating the supply of water to the turbine were set at a constant or fixed position, then each time that a change in load to the turbine occurs, there would be a corresponding change in the speed of the turbine and the generator which it drives. The problem of regulating the speed of an hydro-electric power unit is much more difficult than that of regulating a steam-engine or steam-turbine driven electric generator, for a variety of reasons.

Steam is a highly expansive elastic fluid. In order to regulate the speed of the steam engine, it is only necessary to partially open or close the ports or valves admitting steam to the engine cylinder. This is accomplished in plain slide valve engines by the familiar fly-ball governor, and in more advanced types of steam engines by closely related mechanisms. In order to regulate the speed of an hydraulic turbine with changing load, it is necessary to open or close the turbine gates. The weight of these gates and other connected parts which must be moved is enormously greater than the weight of the valves to be moved in regulating a steam engine. Thus the problem of quickly overcoming the inertia of heavy weights is involved. In the case of the steam engine, the steam pressure at the boiler is usually nearly constant. In the case of an hydraulic turbine, the head operating the turbine may vary within relatively wide limits at different seasons of the year. Thus when the head is reduced by backwater or otherwise, the gate openings must be wider to maintain a given load and speed than at other times. In hydro-electric plants supplied with water by means of closed conduits or flumes, especially if the head is high, sudden reduction in the gate opening of the turbine produces a pressure wave in the penstock similar to the water hammer effect produced when house faucets under considerable pressure are suddenly closed. This pressure wave tends to produce a sudden large increase in the head and pressure, and consequent overspeeding of the turbine at the instant when the gates are closed, or shortly after. This difficulty does not exist in the case of steam engine regulation. These problems have been solved by the use of modern governors for water wheels, to such an extent that the degree of speed regulation obtainable in hydro-electric plants closely approximates that attained in the best of steam driven power stations. The principle of operation of a water wheel governor is essentially the same as that of a steam governor. An incipient change of speed operating on a pair of fly-balls similar to those of a steam engine governor operates what is known as a pilot valve. This is a small valve, easily moved, and consequently sensitive to changes of speed, which admits oil under high pressure to a valve or system of valves known as the "relay." Oil under high pressure, flowing through the secondary valves, actuates an hydraulic piston, which is articulated to the water wheel gates. Thus the work of opening or closing the gates is accomplished by oil under high pressure from an accumulator, which is kept constantly supplied by means of an auxiliary pump. Another important feature of a water wheel governor is the compensator. If controlled by the fly-balls alone, the opening or closing of gates could take place only as rapidly as the speed changes. In that event, speed regulation for hydraulic turbines would be relatively slow and inefficient, furthermore its value might be

largely vitiated by the effect of surges. The purpose of the compensator is to immediately set the governor in operation approximately to the full change of gate opening which will be required for a given change of speed or load without waiting until the full change of load or speed occurs. Governors with compensators have been developed to such a degree of perfection that they will anticipate with but small error the total effect of a sudden change in load on the generator almost the instant that the change in load and resulting change in speed begins to take place. Slight errors in the first adjustment are quickly corrected by successive smaller movements of the governor mechanism, as the gate openings become adjusted to the new load conditions

Pondage and storage may be distinguished in that the former is derived directly from a pond formed by the dam supplying the power plant. It is usually used only for the purpose of supplying a quantity of water greater than the average flow of the stream for the day, during hours when the load or demand for power is maximum. The pond is then allowed to refill during hours of the day when the supply exceeds the demand. When such a pond is drawn down to any degree to supply power, the available head is accordingly reduced, and there is generally an economic limit of the amount of the draft from pondage, since the drawing down of the pond to a greater extent reduces the head to such a degree that the power output is not increased by any further



Pump and Accumulator Actuator

FIG. 6.—Modern Water Wheel Governor.

Fig. 6 illustrates a typical water wheel governor or actuator of the oil pressure relay compensating type. Such an apparatus is almost human in its operation, in apparently anticipating pending load changes, the moment they begin, and correcting the gate opening in advance of the complete load change so as to maintain a constant speed.

Water power which is available continuously, or nearly so, is called primary or firm power. The amount of primary power which a given water power plant can produce is measured by the minimum flow of the stream, either natural or as regulated by storage. Power which can be supplied only part of the year, when the flow of the stream is sufficient to produce it, is called secondary or surplus power. Primary power brings the higher price of the two in the market per horse-power year, often about double that of surplus power. The amount of power available at a given location from a natural variable stream may be increased by the use of pondage, or storage, or both.

use of pondage. Storage, on the other hand, is a term usually applied where water which is not otherwise usable,— that is, waters mainly derived from floods or stream flows in excess of the power plant capacities, are stored and held in reserve by natural lakes or artificial reservoirs. Such stored waters are used to make good part of the deficiency in supply of a natural stream during the low water periods. Storage thus increases the average available output of the plant, regardless of the mode of operation, whereas pondage only increases the available output when the demand for power varies from hour to hour during the day.

In the early days of water power development, water power plant capacities were usually made a little greater than the dry weather capacities of the streams supplying them. For example, a common practice was to make a plant capacity equal to the flow of the stream during the third driest month, in other words, the stream would supply the full capacity of the water power plant during nine months of the

The information in regard to water-power resources is based on est
the Department of Agriculture in 1916 Electric power development in the
maximum horsepower, which is defined as the power available for six mo

DEPARTMENT OF THE INTERIOR
FRANKLIN K LANE, SECRETARY

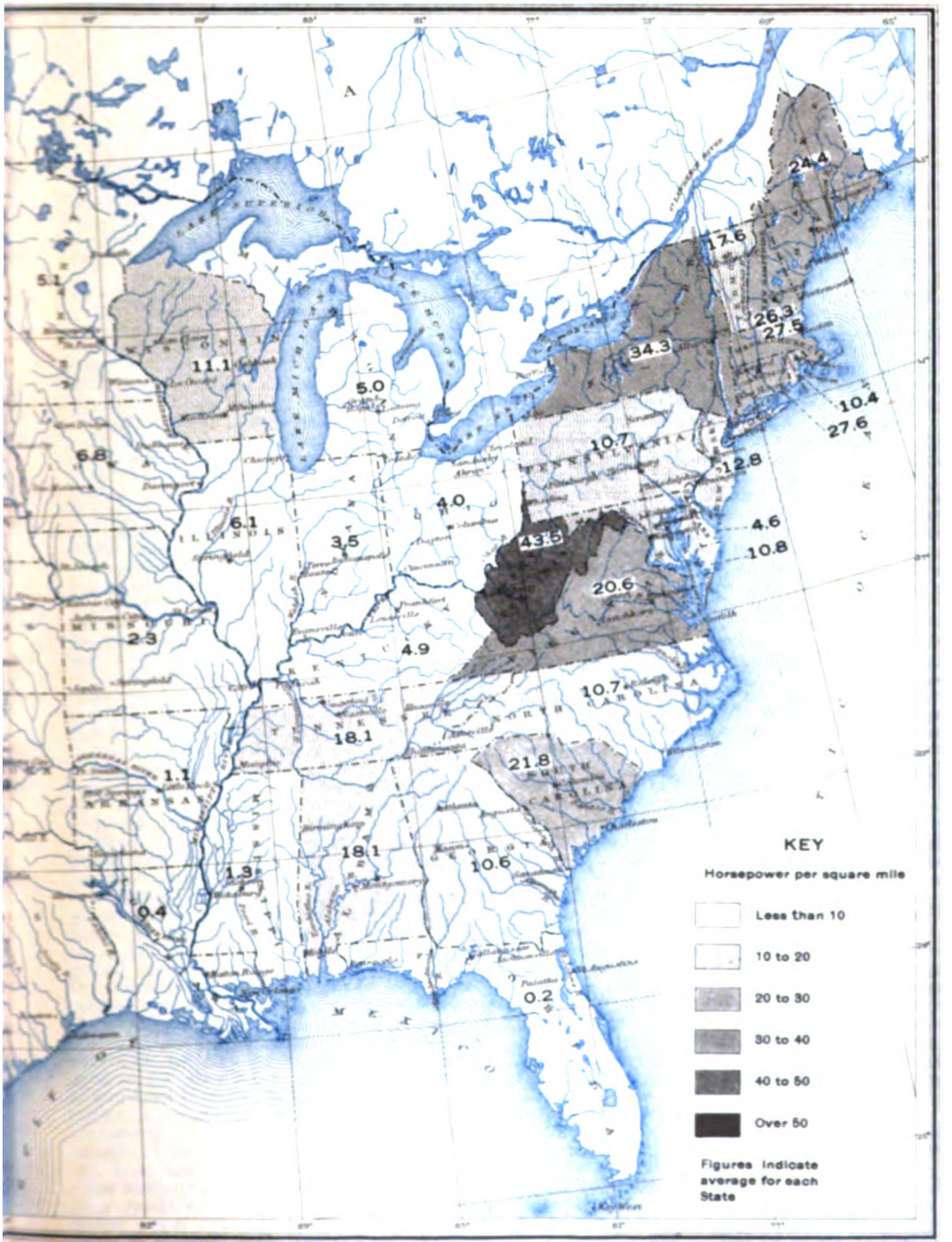
Prepared by W B Heroy

WATER-POWER RESOURCE
Distribution in horse

...compiled by the United States Geological Survey in 1908 and revised by ...ed States, 1916: 64th Cong., 1st sess., S. Doc. 316). The figures show the ...of the year.

DEPT. OF INTERIOR, U. S. GEOLOGICAL SURVEY

U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR



...S OF THE UNITED STATES

...ower per square mile

Miles

Kilometers

Edition of June, 1919

year, on an average When the use of auxiliary steam power became more general, and manufacturing demands increased, the plant capacities of newer power developments were often made equal to the sixth or seventh month's flow in order of dryness, so that the stream would supply the full capacities of the plants during five or six months of the year only, the deficiency during the remaining six or seven months being usually made up by the use of auxiliary steam where a constant power output was required.

Modern large capacity turbines, hydro-electric developments, inter-connected transmission lines, and large demands for power at times for peak loads or break-down service, have brought about an increase in the economic capacity of hydro-electric power developments, until such plants are sometimes installed having capacities equal to the flow of the stream in the ninth driest month, or even greater, especially where there is extensive pondage or storage in connection with the plant, so that power in large quantities can be developed for short time use from impounded water quite independent of the volume of the natural flow at the time. It is seldom commercially feasible, even on the steadiest natural stream, to install a water-power plant having a capacity adequate to utilize the full flow of the stream at all times. As a rule, a large portion of the natural flow during floods goes to waste; furthermore, few hydro-electric plants can utilize all the water which is actually available, but are restricted in their output at times by low demand for power or by varying loads. The ratio of the average to the maximum or peak load output of an hydro-electric power plant is called the load factor. If power is used mainly during certain hours of the day only, as for electric lighting purposes, the load factor is usually relatively low. If power can be used 24 hours per day, the load factor is increased. The reduction of the operating hours from 10 to eight hours in a manufacturing plant, for example, operated by water power without pondage, may reduce the load factor by about 20 per cent, and bring about a corresponding economic loss of water power.

Some of the advantages of water as compared with steam power have been described. Its chief advantage is the saving in coal. This is so significant that in France and Switzerland water power is designated as "white coal." Some of the disadvantages of water power are: (1) A larger investment is generally required per horse power of plant capacity than for steam power; (2) The power must be developed near the place where it naturally occurs, and if desired for distant use beyond a range of a few hundred feet, it must be transmitted by electricity, whereas steam power can be developed at the place where it is to be used; (3) In northern climates the use of water power in winter is sometimes seriously hampered by the occurrence of ice, especially those varieties known as "needle," "slush," or "anchor ice"; (4) Low head water-power developments are often hampered by variations in head, especially as a result of backwater during floods; (5) Water power can only be generated from the water as it comes to the power plant, and since most streams are variable in the amount of their flow, the power output also is variable, unless the stream is regulated by natural or artificial storage. Steam power can be generated at any rate required, up to the limit of the plant capacity.

The Great Lakes afford an example of nearly complete natural stream flow regulation. Small streams are usually more variable than larger streams, and mountain streams, in which the most rapid fall usually occurs, are frequently the most variable. Such streams, however, most often contain available reservoir sites. As a rule, larger streams are not capable of complete equalization of flow by storage for lack of suitable reservoir sites, or if such sites exist their use for this purpose may be inhibited by the economic value for agricultural or other uses of the land which would be flooded. The potential water power of a stream is proportional to the product of its total fall in feet multiplied by the average volume of flow. Often a large portion of the natural fall in a stream, especially a large stream, occurs so gradually that its utilization for water-power purposes would entail the construction of long raceways or conduits at prohibitive cost. In view of the fact that much of the natural flow of streams is unavoidably wasted, and that much of their natural fall cannot be commercially utilized, it is evident that efforts for complete conservation and utilization of natural water resources must be futile. Fortunately, there are many instances where partial conservation of water power which would otherwise waste can be accomplished by storage. Instances where it is physically possible to accomplish these results are more numerous than those where it is commercially feasible.

In order to justify the construction of a storage reservoir for water-power purposes, the cost of the total power produced, including the cost of storage, should generally not be materially greater than the cost per horse power of the power which could be produced without storage. This rule may be modified somewhat by betterment of the grade of power produced by a regulated stream. Sometimes storage reservoirs can be built which will not only serve to equalize stream flow for power purposes, but will perform other important functions, such as the reduction in flood volumes and flood damages at points along the course of the stream below the reservoir. The construction of a storage reservoir useful for both purposes may be justified where its development for power or flood control alone would not be desirable.

A storage reservoir may benefit a water power in two ways: (1) By increasing the average available output; (2) By increasing the proportion of firm or primary power which the water-power plant can produce. In investigations of water-power sites on variable streams, what are known as stream flow or power duration diagrams are commonly used to determine the amount and character of the available power output and the economical size of the power development. Such diagrams also serve to illustrate the benefits to water power which may be derived from storage.

On Fig. 7 the line *ab* shows a power duration curve for a natural unregulated stream. In preparing such a curve, the quantities of flow in the stream day by day or month by month are arranged in their order of magnitude from the greatest to the least, and the corresponding

quantities of power which could be produced by the entire flow of the stream are determined. In Fig. 7 these quantities are plotted as ordinates in terms of percentages of time during which the flow of the stream or power available

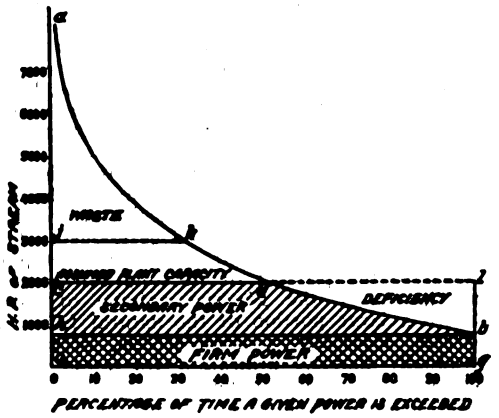


FIG. 7.— Water Power Duration Diagram for an Unregulated Stream.

exceeds a given quantity. These time percentages are shown by the scale at the bottom of the diagram. The total area of the diagram *o-a-b-g* represents the aggregate volume of power available during the year. If a plant having a capacity of say 2,000 horse power is contemplated, then the area of the diagram *o-c-d-b-g* lying below the line *c-d*, corresponding to 2,000 horse power, represents the aggregate average yearly volume of power which would be produced by such a plant, while the area *a-c-d* lying above the plant capacity line represents the volume of power which would be wasted in excess flow or floods. The quantity of firm or primary power which could be produced is represented by the rectangular area *h-b-g-o* lying below the lowest point *b* on the power duration curve, while the area *h-c-d-b* represents the aggregate amount of secondary

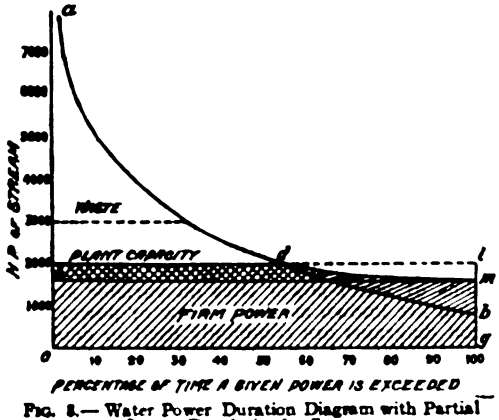


FIG. 8.— Water Power Duration Diagram with Partial Stream Regulation by Storage.

power which could be produced by the given plant. The area *d-l-b* represents the deficiency which must be made up by steam or other auxiliary power in order to produce a constant output of 2,000 horse power of firm power. If the plant capacity was increased to say 3,000 horse power, as indicated by the line *j-k*, the quantity of firm power would remain the same as before, and only the secondary power would be increased. This in turn would not be increased by so great a proportion as the size and consequent cost of the power plant.

These conditions go to fix and determine the most economical size of water-power installation which can be installed in a given case. Fig. 8 illustrates the effect of a partial regulation of the same stream at the same power site by means of storage. The power duration curve as regulated by storage is represented by the line *a-d-m*. The average power output is increased by an amount represented by the shaded area *d-b-m* for a plant of 2,000 horse-power capacity. The firm power is increased to a greater degree, being represented in this instance by the area *m-n-o-g*.

One of the apparent advantages of storage is that the stored water can be utilized over and over again by successive plants located on the stream below the storage reservoir. There are, however, certain disadvantages attendant on the utilization of storage which reduce its efficiency for power purposes. As a rule where a storage reservoir is located at some distance upstream from a water-power development, it is not feasible to discharge the stored water in such a manner as to regulate the stream during only the working hours, so that if a power plant below the reservoir operates during certain hours of the day only, and does not have sufficient pondage to regulate the flow for a 24-hour period, then the storage which is let out of a reservoir at some point upstream continuously during the dry period, will partially go to waste, the waste in extreme cases, for plants operating 10 hours a day without pondage, being as much as seven-twelfths of the entire volume of stored water released. A storage reservoir, therefore, effects the greatest benefit on streams where power plants are located which operate uniformly and continuously or have extensive pondage in immediate connection with the power developments. The quantity of water reaching a power plant located at some distance downstream from a storage reservoir is the sum of the quantity of water discharged at the reservoir and the natural inflow to the stream channel between the reservoir and the power plant. As the distance from the storage reservoir to the power plant increases, the ratio of the latter to the former also increases, with the result that proceeding downstream from the storage reservoir the degree of regulation afforded thereby progressively decreases.

The first hydro-electric central station in the United States was installed at Appleton, Wis., in 1882. The use of hydro-electric power for lighting advanced rapidly during the 80's, this advance following quickly the invention of the incandescent lamp by Edison in 1879. While there were some previous experiments carried out, the first large scale successful long distance power transmission was that from Lauffen to Frankfort, completed in 1891, by which 110 horse power was transmitted a distance of 112 miles at 12,000 volts. This provided the initial stimulus for extensive hydro-electric power development. Prior to that date, water power was not much used for the generation of electric

current unless the water power happened to be located very near the site where the current was to be used.

The growth of hydro-electric power development has taken place mainly along natural economic lines. In general water powers near large industrial centres were developed first, and of these, those involving the lowest primary investment have been given preference; furthermore, the first water power developed in a locality has generally been that having a size suited to the demands of the immediate future. Thus it happens that some of the very largest water powers, as well as numerous smaller ones, have thus far remained undeveloped. The necessity of developing powers of a size suited to the existing market conditions at the time of development is emphasized by the fact that many of the larger hydro-electric developments in the eastern United States passed through bankruptcy, but are now operating successfully. The cause of the financial difficulties was in general that it took too much time to build up an adequate market for the output of a power larger than the immediate demand, and during this time the revenue was insufficient to meet interest payments and other fixed charges on the large investment.

There has been a progressive advance both in the modes and extent of utilization of electric power, especially hydro-electric power. Originally, its principal uses were for street lighting and street railway traction. In eastern United States good roads and automobiles have lessened the latter demand, although in the Pacific Coast States electric railroads afford the principal means of transport between important commercial centres,—coal is more costly—and a large proportion of the hydro-electric power produced is used for traction purposes. In the meantime electric lighting has been greatly increased in efficiency. The amount of current required per candle power is much less than formerly. This has stimulated the use of electricity for lighting purposes, and the demand for electric current for ornamental public lighting, and for domestic and commercial lighting and advertising, is rapidly increasing, especially where current produced by water power can be supplied cheaply.

The introduction of hydro-electric power for manufacturing purposes took place more slowly than its use for lighting and traction. At the start almost every manufactory had its own steam or water-power plant, with a complicated system of shafting and belting to drive individual machines. To replace this system by the use of motor drives for individual machines, equipment representing a large investment must be discarded. The development of highly efficient variable speed motors, with large initial capacity for starting, combined with the many advantages of direct electric drives for each machine, and the increasing cost of coal and labor, have brought about within the past decade a gradual introduction of the use of hydro-electric current for power in manufacturing. This gives promise of rapid extension in the immediate future. Not infrequently manufacturing plants owning water powers have installed electric generators, and have also connected their plants with the transmission lines of commercial electric companies. If, as usually happens on variable streams, the water power alone is insufficient to supply all the power required by the manufactory during low water periods, the current is then purchased from the distributing company to make good the deficiency, instead of generating auxiliary power by steam.

When the stream supplies more current than is required, or at night or other times when the manufacturing plant is shut down, the water power which would otherwise go to waste is converted into electric current, and this is turned on to the commercial distributing lines, thus effecting an interchange of power advantageous to both parties. The use of inter-connecting distribution lines, or of a common distribution system, supplied by several hydro-electric power plants owned by different companies or individuals, with an agreement for interchange of surplus power, is now being accomplished in several instances. This procedure bids fair to stimulate the electrical development or re-development of numerous smaller water powers going to waste through non-use or abandonment, or which are now inefficiently used mechanically for manufacturing purposes.

Fixed charges on initial investments form a large item—amounting often to about one-half the total cost—of hydro-electric power production. As a rule the initial cost of hydro-electric power development of small water powers is relatively high, often prohibitively so. This is especially likely to be the case where the investment includes the cost of transmission lines to market the output. Where a common distribution system is used, a small water power located near a transmission line may sometimes be developed, and its output turned upon the existing transmission line at the requisite phase, voltage and frequency. By thus operating "in parallel," as it is called, the construction of costly transmission lines for small water powers may be avoided in such cases, and a market found for their output. A further stimulus to the use of hydro-electric power in manufacturing is afforded by the increased cost of coal subsequent to the Great World War.

In certain lines of manufacture, non-constant power can be used to advantage, as for example in the grinding of wood pulp for printing paper, a process which consumes relatively large quantities of power, commonly about 75 to 100 horse power per ton of product per day. Such industries afford a market for a large quantity of secondary power from hydro-electric stations.

Electro-chemical industries require large and constantly increasing quantities of electric current, which because of its cheapness compared with steam-generated current, is almost wholly produced by water power. Recently practicable methods of fixation of nitrogen from the atmosphere have been developed. The product is used in the manufacture of explosives, in other chemical industries, and especially as a means of the nitrification and consequent fertilization or otherwise weak, worn-out or sterile soils. The demand for nitrogen compounds for agricultural fertilizers is enormous. Their production from the atmosphere requires the use of large quantities of electric current. Under present conditions the fixation of nitrogen on a commercial basis for agricultural use can only be accomplished where hydro-electric power is available in large quantities at extremely low cost. This is obtained in some instances, in

Scandinavia in particular, and affords a prospective means of utilization of large water powers remote from commercial manufacturing centres.

At the present time, hydro-electric power developments range in size from those of a few horse power, supplying individual farms or small industries, to plants of 100,000 horse power or more, as at Keokuk, Cedar Rapids and Niagara Falls. The number of existing small water powers of 1,000 horse-power capacity or less which are undeveloped greatly exceeds the number of large water powers, but by far the larger proportion of the total output of hydro-electric current is produced by medium-sized plants of 1,000 to 20,000 horse-power capacity, owing to the fact that these have been found to meet more generally the requirements of commercial feasibility for existing market conditions.

Hydro-electric power plants include so wide a variety of natural conditions, types of equipment and methods of development as to be difficult of typical illustration. They range in heads or falls utilized from a few feet to several thousand feet — in voltage the current ranges from a few hundred volts to 150,000 volts — and in distance of transmission of the output the range is from zero to several hundred miles. Certain features are, however, more or less common to nearly all hydro-electric power developments, and these are illustrated by the following examples: Fig. 9 gives an external view, and also a view of the interior, of an hydro-electric power station of the Mengemor Company, Spain. This is a typical cascade development, in that the fall is created by a dam which also provides pondage, and the power station is located immediately adjacent to the dam; Fig. 10 shows an external view, and also a view of one of the turbines and generators, of the hydro-electric power station of the city of Tokio, Japan. This is a high head development of the canal type. Water is brought to the top of the bluff from the Katsura River, which has its source in Mount Fugi, by means of a canal, from which it is conveyed to the power station through steel pipe conduits. The turbines are of phosphor bronze, of 4,500 horse power each, and operate under a head of 315 feet.

Fig. 11 shows the power station and pipe lines supplying it used to generate electricity for the city of Bellinzona, Switzerland. This is a very high head development, in which water wheels of the impulse, or Pelton type, are used, as shown in Fig. 11-*b*. The head or fall operating the water wheels is 1,132 feet. The water is brought down from the source of supply above the crest of the mountain through the small pipe line shown in the background in Fig. 11-*a*.

Fig. 12 is a view of the interior of the Estacada plant of the Portland, Ore., Railway Light and Power Company. Here a pair of spiral case Francis type turbines is connected to each of the generators.

The total mechanical power used in the United States is estimated at about 180 000,000 horse power. The larger proportion of this is used by railroad locomotives, and for a wide variety of miscellaneous purposes. The amount of power used directly in manufacturing was estimated in 1909 as 18,680,776 horse power. Of this only 1,882,573 horse power was produced directly by water power, and about an equal amount of hydro-electric power was purchased for manufacturing use. Central electric light and power stations produced at the same date about 7,500,000 horse power.

The developed water power of the United State was estimated at 6,000,000 horse power in 1909. While the total water power of the streams of the United States exceeds 100,000,000 horse power, the larger proportion of this is not capable of profitable development at the present time.

Thus while it appears probable that there may be a material increase in the use of water power in the near future, and consequent reduction in the annual coal consumption, it must be expected that an enormous consumption of coal for power purposes will continue for many years. The total water-power resources of the world have been estimated at about 700,000,000 horse power. See HYDRAULICS.

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WATER PURIFICATION. See WATER SUPPLY; WATERWORKS.

WATER-RABBIT, or SWAMP-HARE. See HARES.

WATER-RAIL, a species of rail (*Rallus aquaticus*) widely distributed over Europe, Asia and North Africa and generally common, but, on account of its retiring habits and shyness, not often seen. It is about 11 inches long, olive brown above streaked with black, the under parts gray and the sides streaked. It frequents marshes and bogs, dives and swims well, but is a poor flyer. It is a delicious table-bird. In North America its nearest representative is the king rail (*R. elegans*). The name is applied generally to other species of aquatic rails (q.v.) in distinction from the land-rails and crakes (q.v.).

WATER RAT, or VOLE. See VOLE.

WATER RIGHTS. See RIVERS; RIPARIAN RIGHTS.

WATER-SCORPION, a bug of the family *Nepidæ*, whose species inhabit ponds and take their popular name from the scorpion-like form of the fore-legs, with which they seize their prey. The remaining two pairs are slender and locomotory, and the abdomen terminates in a long, slender breathing tube. Some of the species carry eggs in a layer on the under side of the abdomen. *Belostoma* includes the largest species with flattened bodies and four-jointed antennæ; *Nepa* is much flattened and oval and the antennæ are three-jointed and lamellate; while *Ranatra* includes species of linear form. The larvæ and nymphs of the water-scorpions resemble the imagoes in general aspect, but lack the

wings of the latter. In all stages they are sluggish in movements and secure their prey by hiding and stealth. These insects are very interesting in habits and structure. See FRESH-WATER INSECTS.

WATER SHELL. See ORDNANCE.

WATER-SNAKE, a harmless colubrine American snake (*Natrix fasciata*), closely allied to the garter-snakes (q.v.), but of aquatic habits, swimming and diving with great ease and skill and spending its life largely in streams, ponds and marshes. It lives largely upon fish, either alive or dead, frogs, tadpoles, newts and aquatic insects and other small creatures. It is mottled in variable dull tints and is lively and pugnacious. Its eggs are laid in holes in stream banks and similar places. The common grass-snake (q.v.) of Europe, the only British serpent except the viper, is a near relative. The wart-snake of East India (*Acrocordus javanicus*) and the sea-snake, a venomous fish-eating hydrophoid of the Indian Ocean, also bear the name of sea-snake.

WATER SOFTENING, specifically the process of eliminating from water the calcium (lime) and magnesium compounds which combine with soap, forming insoluble curds and prevent the formation of lather, thus making the water "hard." In general the term embraces all forms of removal from water of any substance, lime, magnesia, acid, silt or other material which renders the water unsuitable for industrial use. The process has usually three phases: (1) the removal of scale-forming substances; (2) the neutralization or removal of corroding substances; (3) the separation of suspended matters. The first two are chemical; the third, mechanical. Rain water contains only the soluble gases of the air, carbonic acid gas, oxygen, ammonia and sulphurous acid and such dust and dirt as it may have washed out of the air in its fall. The water falling at the last end of a long rainstorm is nearly pure. Such water mixes readily with soap to form a slippery lather and the water is said to be soft. If rain water runs down a clean, grassy slope to a stream, it is still nearly pure soft water. If it runs over limestone or ground containing particles of limestone, it dissolves a small amount, perhaps two grains per gallon (of 58,391 grains) or one part of limestone to about 29,000 parts of water; but for practical purposes this is still called soft water. If, however, the rain water sinks into the ground to remain a long time in contact with limestone, it dissolves greater amounts, frequently 20 grains per gallon of water and sometimes more than 100 grains per gallon. Water is commonly said to be hard if it contains more than five grains per gallon. Deep well waters are nearly always of this nature. In the arid plains of the western part of the United States where the soil contains large quantities of common salt (chloride of sodium) and the other salts of sodium and potassium which are all readily soluble in water, the well waters are usually heavily charged not only with the salts of calcium and magnesium but also with the salts of sodium and potassium and such water is called alkali water. The water which is found near the coal fields frequently contains sulphuric acid to the amount of two or three grains per gallon. Lakes contain the waters of many creeks and rivers and are usually soft water; but the current is slow or absent altogether and the evaporation from the broad surface has the effect of concentrating the volume of dissolved salts so that lake water contains rather more mineral matter than river water and is frequently on the border line between soft and hard. Lake Erie water, the softest of all the lakes, contains about five grains per gallon of the salts of calcium and magnesium. The oceans are the final receptacles for the waters of the rivers and lakes and are subject to continuous evaporation, so that in the course of years the mineral matter has become concentrated and ocean water contains about 2,100 grains per gallon of mineral matter, made up of calcium carbonate, eight grains; calcium sulphate, 75 grains; magnesium sulphate, 99 grains; magnesium chloride, 230 grains; potassium sulphate, 55 grains; and sodium chloride, 1,633 grains; the great amount of sodium chloride and the relative scarcity of calcium and magnesium compounds being due to reactions which have taken place in the water, precipitating the salts last mentioned. Great Salt Lake in Utah and the Dead Sea in Palestine (q.v.) are small bodies of water, like oceans, without known outlets, and since the rivers feeding them are heavily charged with common salt, these lakes contain much more of it in proportion than the oceans. Ocean water contains about 3.5 per cent mineral matter, the Dead Sea 26 per cent and Great Salt Lake averages about 20 per cent.

When hard waters are evaporated the mineral matter is left in a solid mass, interesting examples being found in the stalactites and stalagmites in caves and in the deposit in the bottoms of tea kettles. The most serious damage produced by hard water in industrial operations is the scale deposited in steam boilers and the waste of soap in washing. Scale in boilers is a deposit of the mineral content of the water evaporated, due in large part to the fact that some of the dissolved salts are more soluble in cold water than in hot and as the temperature rises the overplus is precipitated as a crust on the inside of the boiler plates. This condition prevents the easy passage of heat from the fire to the water and shortens the life of the boiler because of the excessive temperature to which the steel must be raised in order to force the heat through the scale to the water. The average heat conductivity of boiler scale is one-thirty-seventh of that of the iron of which the boiler is made when the scale is thin. If thick this figure is much too large. The amount of extra fuel required to evaporate water in a boiler which is coated with scale varies with the thickness and character of the scale and with the rate at which the boiler is worked. When the boiler is being driven to nearly its full capacity, the amount of additional fuel required by a one-quarter-inch layer of scale is frequently as much as 50 per cent; but if the boiler is being worked at only half its capacity the difference may not be more than 10 per cent. Nearly all tables of such data are based on measurements of the additional amount of fuel required in a scale-covered boiler to heat the water at the same rate as in a clean boiler worked at normal capacity. It is estimated that the railroads of the United States are spending at least $15,000,000 annually in additional fuel

and boiler repairs due to the hard and muddy water used in some parts of the country. Using hard water in boilers is much more expensive than softening it, since on the average 1,000 gallons of hard water will do 50 cents worth of damage in fuel and repairs, while 1,000 gallons of hard water may almost always be softened for less than 3 cents. The value of the soap wasted by hard water is enormous, amounting to 1.7 pounds per 1,000 gallons of water for each grain of hardness, or 17 pounds per 1,000 gallons of water 10 grains hard per gallon, a value of at least 70 cents, when it would cost perhaps two cents per 1,000 gallons on the average to sufficiently soften such water.

The chlorides and sulphates of calcium and magnesium are readily soluble in water, but the carbonate of lime or magnesium (marble or ordinary limestone) is soluble only in water which contains carbonic acid gas (CO_2). The greatest difficulty with the magnesium salts is that they prevent or delay the removal of the calcium salts and by their presence raise the point of solubility for calcium carbonate. An increased addition of lime in this case results in the formation of magnesium hydroxide which forms very slowly and is very likely to assume a colloidal form, absorb carbonic oxide from the air and return to its first form. Calcium carbonate will remain in solution in ordinary samples of water to the extent of 2.04 grains per gallon. This amount, however, is not large enough to rate the water as "hard." If all the carbon dioxide is removed from the water the limit of solubility will be only 1.08 grains per gallon. And this remnant cannot be dislodged by the addition of caustic lime. Magnesium carbonate is much more soluble where carbon dioxide is present and while it rarely exceeds five or six grains per gallon, it is sometimes in much larger quantity. Even though all the carbon dioxide be removed the content of magnesium carbonate may remain at 12 grains per gallon. The higher the pressure in a boiler the more of this salt will be held in solution. Magnesium chloride, although highly soluble, is very objectionable in boiler water because of its tendency to decompose and produce hydrochloric acid, which is extremely corrosive. Calcium chloride is more stable, but under high pressure is believed also to break down into hydrochloric acid. It is a simple matter to soften water which contains only the bicarbonate of calcium, because it is necessary only to steal away the extra molecule of CO_2 by adding a little fresh-slaked lime which has a great affinity for carbonic acid gas and combines with it to form a molecule of mono-carbonate of calcium, which is insoluble, and, like the remaining molecule of mono-carbonate, settles to the bottom as precipitate. The chemical reaction is stated thus:

Calcium bicarbonate		Slaked lime		Calcium mono-carbonate		Water
$CaCO_3(CO_2)$	+	$Ca(OH)_2$	=	$2CaCO_3$	+	H_2O

and thus there is precipitated to the bottom not only the original dissolved limestone but also the slaked lime which has become limestone by uniting with the molecule of carbonic acid gas which held the original limestone in solution. This discovery or invention was made in England by Dr. Clark about 1840 and no better or cheaper method has since been found for removing carbonate of lime from water. Calcium carbonate alone does not form a hard scale in boilers but produces a soft, slimy silt. In combination with other salts, however, it makes the hardest of scale.

In the case of the sulphate of calcium heavy crystals are deposited whenever the boiler pressure reaches or exceeds 50 pounds. The sulphate of calcium scale is regarded as worst of all. The solubility of calcium sulphate is increased by the presence of magnesium chloride and decreased by the presence of calcium chloride. At high boiler pressure very much less of calcium sulphate is held in solution, the excess being precipitated. At ordinary temperatures water will hold in solution 150 grains per gallon. At a temperature of 356° F., equivalent to a pressure of 132 pounds per square inch, the solubility per gallon is but 16 grains, the remaining 134 grains per gallon having been deposited as scale. The ordinary method of taking out sulphate or chloride of calcium is to add to the water the proper amount of sodium carbonate (soda ash or washing soda), when the sodium and calcium exchange acids as follows:

Calcium sulphate		Sodium carbonate		Calcium carbonate		Sodium sulphate
$CaSO_4$	+	Na_2CO_3	=	$CaCO_3$	+	Na_2SO_4

The calcium carbonate settles as a precipitate while the sodium sulphate remains dissolved in the water, and, for boiler or washing purposes, is harmless in any ordinary amount. In water softening operations the treatment for the magnesium salts is practically identical with that for calcium salts. Mud in suspension is taken out of soft water by introducing a coagulant, as alum, or the combination of two substances which will form a precipitate — such as sulphate of iron and caustic soda, so that the precipitate in settling will carry down with it the fine particles of mud. The oil taken up by steam in engine cylinders is extracted from the condensed water in the same way, so that the water may be used again in the boilers. For boiler purposes it is most important that the softened water should be freed from precipitate and made perfectly clear, because the presence of particles of solid matter suspended in the water is the most potent cause of boiler foaming. When the reactions take place and the young and fine precipitates are formed, in the presence of old precipitate, an agglomerating action results which gathers the small particles together in balls so that they settle readily. The best machines in use for carrying out these processes are automatic in their action and require only to be supplied with chemicals and to have the settled precipitates discharged by opening a valve at the bottom of the settling tank, each once in 24 hours.

The most recent and apparently the most successful of all water softening processes is the use of zeolites, natural or artificial. These substances are silicates containing water, and which, in contradistinction to other silicates, decompose and are soluble in dilute acids. The artificial form is produced by fusing together feldspar, kaolin, pearlash and soda in certain fixed proportions; and goes by the commercial name of "permutit." Two forms are in use — sodium permutit and manganese permutit.

When water is made to flow through a layer of sodium permutit, the latter exchanges its soda for the calcium and magnesium salts of the water and the degree of hardness in the latter is reduced to zero. The permutit has to be regenerated as it grows lax in action. This is easily accomplished by washing it for a few hours with a solution of common salt. Manganese permutit in connection with marble dust removes all iron and acids from waters thus affected.

The practice of softening the entire water supply of a municipality has grown steadily and in not a few large manufacturing cities the municipal softening plant is saving the citizens hundreds of thousands of tons of coal per annum and adding years of life to the community's boilers. The principal requirements are (1) mixing chambers, in which the softening chemicals are thoroughly mixed with the water; (2) capacious settling basins sufficient to give the necessary time for the slower reactions when the temperature is low, as in winter; (3) a device for adding a coagulant (alum or ferrous sulphate) at both the entrance port and the exit port of the water into and from the settling basins; (4) substantial mechanical filters. In addition, as one of the requisites should be a special apparatus to slake the lime, reduce it to a proper emulsion and feed it in proper quantity automatically into the flowing water.

At the municipal water softening plant at Cleveland, Ohio, 150,000,000 gallons of water per day require the daily application of 40 tons of quicklime. This is slaked with hot water, mixed into an emulsion in an agitator, taken to tanks where it is cooled and diluted to the proper consistency and finally pumped at a uniform rate into the flowing water.

In a recent report (1916) upon a water supply for the city of Sacramento, Cal., the relative hardness of the available waters was considered in estimating the cost of the project. The engineers showed that while a supply of water from ground wells would be cheapest in initial outlay, that the water of the Sacramento River would be more economical for the consumers because of its lower degree of hardness; the ultimate figures being $38.40 per 1,000,000 gallons for the river water as against $42.40 per 1,000,000 gallons for well water. On the basis of the city's daily consumption of 30,000,000 gallons the saving in soap alone to the consumers amounted to $120 per day.

Consult Booth, W. H., 'Water Softening and Treatment' (London 1906); Christie, W. W., 'Water: Its Purification and Use in the Industries' (New York 1912); Whipple, G. C., 'The Value of Pure Water' (New York 1907).

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WATER SUPPLY: For Municipal, Domestic and Potable Purposes, Including Its Sources, Conservation, Purification and Distribution. Introduction.—This article does not treat of water supply for navigation, irrigation or power development, but is confined principally to the consideration of the sources, collection, conservation, purification and distribution of water for municipal, domestic and potable purposes. This is becoming an increasingly engrossing subject for all progressive communities, since scientific research has shown that many natural waters are the media for the propagation and dissemination of countless colonies of micro-organisms of vegetative and animal growths, including bacteria, some of which are pathogenic. Some water bacteria have been localized and classified as shown by Prescott and Winslow in their 'Elements of Water Bacteriology.' Many other micro-organisms have also been localized and classified as shown by George C. Whipple in his 'Microscopy of Drinking Water.' The nature and characteristics of some of these organisms must be studied in all water supply problems and therefore will be considered to some extent under some of the subtitles to follow.

In 1857 Nägel suggested the name "schizomycetes" for all micro-organisms and that designation is used by some bacteriologists for all such organisms. Botanists use that designation for vegetative organisms. "Bacteria," however, is the name usually applied to living organisms in water. Many of these infest surface and ground waters. Neither lakes, rivers, ponds, nor wells are free from such micro-organisms. Not infrequently thousands of bacteria are found in a cubic centimeter of natural, which is usually denominated "raw" water. Dr. A. H. Hassall of London (1850) is reported to be the first to identify living organisms in drinking water. He was followed by E. N. Horsford, L. Radlkofer, Ferdinand J. Cohn, James Bell, L. Hirt, W. G. Farlow, Ira Remsen, H. C. Sorby, J. D. Hyatt, George W. Rafter, George C. Whipple and others. Dr. A. C. Houston of the London Metropolitan Board in 1912 reported 10,315 microbes per centimeter of raw Thames water, although says Prof. William P. Mason "it is now generally admitted that such a medium is not favorable to their growth." Dr. Houston found that they lived longer in deep Loch Katrine water, one of the sources of supply for Glasgow, than they did in the Thames.

Dr. Robert Koch traced the cholera epidemic of 1892, in Hamburg, which did not prevail in Altona across the Elbe, to the contamination of its unfiltered raw river water supply by the cholera germ, *spirillum choleræ Asiaticæ*, or *comma bacillus*, discovered by Koch in 1884. Altona used filtered water from the Elbe and largely escaped that cholera epidemic. Since the discovery of the specific cholera germ by Dr. Koch, greater caution is exercised by municipalities to prevent the contamination of their water supplies by the *spirilla choleræ Asiaticæ*, and cholera epidemics are less frequent. In 1887 Messina, Sicily, had an epidemic of cholera due to polluted water. Typhoid epidemics have occurred more frequently than Asiatic cholera, for the typhoid bacilli (*B. typhosi*) are more generally distributed and the contamination of water supplies thereby has been not uncommon. George C. Whipple in 'The Microscopy of Drinking Water,' p. 80, says, "All quiescent surface-waters are liable to contain microscopic organisms in considerable numbers. The water that is entirely free from them is very rare."

From the 'Waterworks Handbook' of Flinn-Weston and Bogert and other publications are excerpted the following data as to bacterial contents of a few river waters per cubic centimeter.

Bacteria in the Niagara vary from 10,000 to 300,000 per cubic centimeter; in the Seine from 300 per cubic centimeter above Paris to 200,000 per cubic centimeter below Paris; in the Spree from 82,000 per cubic centimeter above Koepenick to 10,000,000 per cubic centimeter at Charlottenburg; in the Ohio they averaged 16,500 per cubic centimeter; in the Delaware 7,680 per cubic centimeter; in Crystal Lake, Mass., 185 per cubic centimeter; in Lake Ontario 7,040 per cubic centimeter; in the Mississippi upwards of 2,000 per cubic centimeter; in the Potomac upwards of 4,000 per cubic centimeter and in the Merrimac upwards of 11,000 per cubic centimeter; in raw Thames water 10,315 microbes per cubic centimeter; and in the Isar at Munich opposite an effluent of sewage 121,861 per cubic centimeter. In some waters bacteria have exceeded 200,000 per cubic centimeter. Nearly all surface waters have some bacterial content and in many cases the bacteria are pathogenic. Neither are all springs nor well waters entirely free from bacterial infusion. This may not be sufficient nor of the kind to pollute such waters for some genera are not pathogenic. However, it has been contended that some non-pathogenic bacteria may become pathogenic under favorable conditions. That is notably so in the case of *bacillus coli communis* (*B. coli*), when nourished on sewage and on other typhoid waste.

Ground waters, including wells, in some localities are infested with *crenothrix* at the number of 20,000 per cubic centimeter and with similar organisms, where iron and manganese are found. The *crenothrix* flourishes in waters impregnated with iron and *crenothrix* itself secretes iron and clogs water pipes. Many other species have been found in ground waters, though they may not all be pathogenic. Some time ago the Massachusetts Board of Health tabulated those found in ground waters. In recent years, possibly from China, there have been imported with livestock, or by means of their hides, the dread anthrax spores (*B. anthracis*) discovered by Robert Koch in 1876, which have been discharged from tanneries into rivers. They are immune to the ordinary agencies used for the sterilization or purification of water supplies. Turneaure and Russell reported in their 'Public Water Supplies' that in Medford, Wis., a well was contaminated by surface water draining into it from a field, where cattle had died of anthrax or splenic fever.

The *bacilli tetani* (*B. tetani*) and many other species have been discovered in raw river water. In 1900, George C. Whipple compiled data showing the relative abundance of *diatomaceæ*, *chorophyceæ*, *cyanophyceæ* and *Protozoa* in 57 lakes, ponds and storage reservoirs of Massachusetts. Consult Whipple's 'Microscopy of Drinking Water' pp. 139–141. None of such waters were entirely free from some one or more genera of such organisms. They may be considered as fairly representative of all surface waters.

As a result of the prevalence of pathogenic bacteria in water supplies, waterborne diseases are many and include those already mentioned and many other intestinal, tubercular and other disturbances. It is the aim of modern research to prevent all such diseases and to that end new processes for the purification of water supplies have been perfected. New standards of purity and wholesomeness have been established to which water supplies must conform before they are considered safe for potable uses. Some of these will be considered in this article, which will comprise several subtitles.

Primitive Conditions.—In the primitive conditions of society the water supply of a territory received but little attention. The early inhabitants of the world were more interested in its availability and abundance than they were in its quality. Accordingly the most populous settlements were those along oceans, seas, gulfs, bays, lakes, rivers and watercourses generally. Early palæolithic remains have been found along the Thames. In the Stone and Bronze ages dwellings for human habitation were built on poles in the lakes of Switzerland, the British Islands and elsewhere and mounds were constructed along the coasts in Scandinavia. Their occupants were thus abundantly supplied with water as well as protected from the ferocity of wild animals. Primitive peoples, however, knew little or nothing about the animal and vegetative organisms, in surface, running or stored-up water. At first there was little, if any pollution of watercourses by human agencies. The early inhabitants supplied their needs from nature's inexhaustible reservoirs without fear or even the knowledge that water in any of its manifold forms might be unsafe for domestic or for general potable uses. That is a matter of recent deduction from the slow discovery of species of pathogenic bacteria, in surface and other polluted waters. Some of these develop and propagate readily when taken into the human system as do *bacilli coli communis*.

Prior to the 19th century of our era there are few extant records of the ravages of diseases and the destruction of human life, attributed to the potable uses of unwholesome water. Many wasting fevers, pestilences and plagues are recorded in history prior to the discovery of the deadly species of microscopic organisms in contaminated water, but their causes were unknown. As the population increased and extended from watercourses inland, tanks, storage reservoirs and canals were constructed as they were in Assyria, Babylonia, Egypt and China. The sources of the Tigris and Euphrates and the waters of those rivers themselves were conveyed through a network of canals to water the many cities of Mesopotamia whose water jars have been found at Nippur and elsewhere. Khammurabi provided for the protection of some of such canals in his Code of Laws, promulgated 2250 B.C. Egypt was watered by the Nile, whose constant flow was maintained by drawing upon the impounded waters of Lake Moeris. Asia Minor had many springs, notably those in the valley of the Mæander. The Arabians utilized extinct volcanic craters as reservoirs for the accumulation of waters. Greece had its rivers, springs and infiltration galleries. Rome had its lakes, springs, aqueducts, reservoirs and rivers. Carthage and Palestine had their wells, cisterns and pools, supplied by mountain streams. India had its rivers, canals and reservoirs. All those ancient peoples and also the Chinese had their deeply driven wells, which supplied their best waters. Herod-

ous, Hippocrates, Strabo, Pliny and others wrote on the water supply of various countries.

Æschylus in his 'Eumenides' speaking through Athena said:

Κοπαν ἐπιῤῥοαισι· βαρβόρῳ θίξαν
λαστρὸν μιαινων οὐκετ' εἰσφρεις ποτόν.

which has been translated as follows:

"But if with streams defiled and tainted soil
Clear river thou pollute, no drink thou'lt find."

thus warning the Athenians of the dangers in polluted water.

Hippocrates recommended that drinking water be filtered and boiled before using it. That is some proof that he realized that raw water ought to be sterilized before it was drunk. The Romans knew that some waters were unsuitable for drinking purposes and used their poorer qualities for irrigation, municipal fountains and other public non-potable purposes. Not until the advancement of science in the 19th century had revealed waterborne diseases, did the quality of the water supplies of communities arouse public attention.

The Germ Theory of Disease.— The modern sciences of bacteriology and biology revealed the nature and activities of myriads of microscopic organisms in impure water hereinbefore partially described and how they become the media of infection and the agencies for spreading diseases. After the discoveries of Theodor Schwann, Louis Pasteur, Robert Koch, Ferdinand J. Cohn, Joseph Lister and others during the last century "the germ theory of disease" was generally accepted. Those pathologists turned their attention to the discovery of means of combating the active agencies that were destructive of human life. They made several important discoveries of antitoxins, serums and lymphs of inestimable pathological utility to the race. These, however, were insufficient to check the ravages of all infectious diseases, some of which, as was stated, are transmitted through living organisms in potable waters. That led to the study of the water supplies of communities, one of the most engrossing subjects of the last and present century. Municipalities and communities generally for their own welfare must consider and solve this problem regardless of the expense thereby entailed upon taxpayers, for it is growing in importance in many habitable parts of the globe with the ever-increasing density of population. Before entering upon the study of the processes for the purification of water supplies, it may be well to consider some of the physical conditions that contribute to the production of the abundant waters, found in the habitable portions of the earth.

Earth's Water Supply.— Three-fourths of its surface is covered with salt water and from those inexhaustible fountains of the deep the heat of the sun is continually drawing invisible vapor up into the strata of the atmosphere, where the aqueous vapor is cooled and becomes visible and is wafted landward over continents. It comes in contact with hills and mountain ranges and is precipitated in rain and snow and so replenishes the infinite watersources of the uplands of the earth. Whether in some one of its varied forms, it accumulate in insurmountable masses of snow, giving mountain ranges their names as it did the Himalayas, or in another form it become rivers of ice, like Alpine glaciers to form such commerce-bearing rivers as the Rhone, or in another form it roll in ceaseless tidal billows encircling the globe, or still in another form it float in vaporous clouds landward to fall in refreshing rains over vast areas of territory to percolate the soil and be stored in an infinite number of natural reservoirs, whence it flows in countless streams to nourish the fruits of the earth and supply the wants of man, it conditions and largely controls the activities of every generation and will continue so to do for all time.

Next to the free air we breathe, water is man's greatest earthly possession. Water is freely showered upon the earth in abundance and is stored up in countless pools, ponds, ground waters, subterranean springs and other natural reservoirs and is accumulated in brooks, creeks, streams, rivers, lakes, sounds, bays, seas and the oceans, covering three-fourths of the earth's surface and making habitable a large part of the remaining fourth. Its distribution is affected by the uplift and physical configuration of continents and their relation to oceans, the rotation of the earth upon its axis, the temperature, humidity, succession and varying seasons, climate and trade and other prevailing winds. All of these and other natural phenomena more or less condition the amount of precipitation over different areas. Some lofty mountain ranges, continually intercepting vaporous clouds swept inland from the oceans and seas, are capped with permanent masses of snow, which are unfailing sources of water supply for great rivers like the Amazon, the Yukon, the Rhone, the Ganges and others. Other mountain ranges cause almost daily precipitation in the form of rain, which collects in innumerable natural basins on the surface and below it, but high above the sea-level. These are the source of mountain streams and of the occasional underground flow found in some mountain regions. The amount of precipitation varies over different areas. In the polar regions there is no rain and all precipitation there is congealed in the form of snow and icy particles. Rainfall or precipitation is quite fully treated in the special article under the title, RAINFALL, in Volume 23 of this Encyclopedia, to which reference is herein made for the amount thereof over various areas of the habitable globe.

Under the operation of natural laws only a part of rainfall can be collected, conserved and made available for human needs. As announced under the article on RAINFALL communities must also consider its disposal. That will appear from what follows.

Disposal of Precipitation.— Water from rain or melting snows disappears from the catchment areas, (1) by evaporation, (2) by transpiration, (3) by runoff and (4) by percolation. These methods dispose of varying amounts dependent somewhat upon the surfaces, whether land, or water, the seasons, climate, temperature, locality, altitude, vegetation, character of the soil and other physical conditions. They may be briefly stated as follows:

(1) Evaporation to some extent already considered under the article on RAINFALL may

dispose of any part or all of the rainfall over a limited area and in some instances evaporation may exceed rainfall, as it did in Massachusetts in 1883. Evaporation goes on from ice and snow less rapidly than from land or water surfaces. Vegetation and trees intercept precipitation and also retard evaporation. They tend to increase percolation for the moisture penetrates the soil in and about the roots and is held there until it percolates into the deep strata of the earth. Various formulæ have been deduced to determine evaporation, as stated in the article on RAINFALL. These, however, are not conclusive.

Capillary attraction acts upon water 30 or more inches below the surface and occasionally lifts a film of water 6 to 30 inches above the ground-water level and so aids evaporation. Wilton Whitney, in 1897, reported ('Agriculture Year Book') that capillarity drew moisture up 20 feet or more to nourish crops in the soils of California. Prof. J. B. Stewart of the Agricultural College of Michigan reported that capillarity operated upon water from 45 to 70 inches below the surface. The depth of the water-table below the surface is not uniform and varies in different localities. In the Central States it was found by W. J. McGee to be about 22 inches below the surface. Charles H. Lee of the Geological Survey was of the opinion that the capillarity lift is limited to four feet in coarse sandy soil and to eight feet in fine sandy and clay soils. Thus by the operation of natural laws is the verdure of the earth nourished and sustained from the waters below, though there be insufficient precipitation from above. Warm sunshine and gentle winds increase evaporation.

From some soils evaporation averages 16.68 inches annually, where the rainfall is 30.29 inches and the percolation 13.61 inches. Over the Ohio River watersheds, where the rainfall averages 41.1 inches, the evaporation averaged 14.8 inches; over the James River watersheds, where the rainfall averaged 42.1 inches, the evaporation averaged 16.3 inches; and over the Sacramento River watershed, where the rainfall averaged 32.2 inches, the evaporation averaged 8.5 inches. Evaporation from the Croton watershed was computed by John R. Freeman for a period of 32 years at 24.74 inches. Evaporation has been computed over the Sudbury watershed at 23.63 inches and at Nashua at 23.76 inches. From water surfaces evaporation is much greater than from land surfaces. From the Chestnut Hill reservoir near Boston for a period of years it averaged 39.2 inches and from a water surface at Croton, N. Y., it averaged 39.68 inches. From Mount Hope reservoir at Rochester for 10 years, it averaged 44.45 inches, from the Muskingum River 40 inches, from Owens Lake, California, 80 inches, from Yakima River, Washington, 32.8 inches, from East Lake, Birmingham, Ala., it ranged from 52.1 inches to 69.4 inches.

The United States Weather Bureau and United States Department of Agriculture for some years have compiled a record of evaporation from the principal watersheds of the United States. These show that about two-thirds of rainfall or precipitation over the United States is disposed of by evaporation. In Massachusetts in 1883, evaporation was 39.12 inches and rainfall was only 32.78 inches.

From a water surface at Lea Bridge, England, it averaged 20.6 inches, whereas for 14 years it averaged 18.14 inches from land surfaces, where the rainfall was 25.72 inches. At Rothamsted, England, evaporation averaged 10.68 inches, where rainfall averaged 30.29 inches. From Talla reservoir, Edinburgh, it averaged 15 inches. The characteristics of land areas and their general physical conditions, together with atmospheric influences, affect evaporation.

(2) Transpiration also disposes of an appreciable amount of rainfall in some localities through grasses, grains, other vegetation, shrubbery and trees and by them returned to the atmosphere. *Bulletin No.* 285 of the Bureau of Plant Industry of the United States Department of Agriculture shows the water requirements of various cereals and plants. Prof. Adolph T. Meyer states that "For grasses and grains the ratio of pounds of water used to pounds of dry substance produced varies from 300.1 to 600.1." B. E. Livingston has undertaken to show (40 *Botanical Gazette* 31) that there is a direct relationship between transpiration and the weight of vegetables produced. The Department of Agriculture of the United States has also undertaken to show that the yield of grain of an area is approximately proportionate to the water consumed. It will thus be seen that large quantities of water are taken up by the growing vegetation and forests of the earth and returned to the atmosphere. Growing crops absorb from 9 to 10 inches of rainfall and brush and trees from 4 to 12 inches of rainfall according to estimates made by Professor Meyer. Nearly all such water escapes from the stomata of leaves into the air, for the amount retained is very slight. Raphael Zon of the United States Forestry Bureau reported in 1913, that one acre of oak forest in Austria absorbed upwards of 2,227 gallons of water daily, which was equivalent to a rainfall of 12½ inches in a period of five months. These figures indicate the enormous quantities of water given off by forests into the air.

The United States Department of Agriculture collected data in Central Europe showing the transpiration from forests to equal one-fourth the rainfall there. From deductions of M. W. Harrington it appears that much of the rainfall is transpired into the atmosphere by green crops and three-fourths of it from some forests and less than one-third from bare soil. During the growing season plants and trees draw moisture and water from the subsoils and thence it escapes into the atmosphere. The amount of water so taken from the ground by the capillary attraction in vegetation, plants and trees and by them transpired into the atmosphere varies greatly under different physical conditions, but enough has been stated to indicate that an appreciable part of the precipitation is thus disposed of and under some conditions that amounts to 20 inches.

(3) The runoff from different watersheds also varies greatly, depending upon their physical characteristics, including their geological structures and configuration. Sandy surfaces freely absorb water and from them there

is little runoff, whereas clay and rocky soils absorb but little rainfall and from such surfaces the runoff is large. Steep slopes also shed water freely, whereas forest-clad areas retard, absorb and retain a large part of the rainfall. The following data will illustrate the amount of water disposed of in the localities mentioned by runoff. The runoff waters from catchment areas or watersheds accumulate in pools, ponds, lakes and rivers and become one of the two available sources of water supply, the other being ground-waters. From the Genesee River at Mount Morris, N. Y., from 1892 to 1898, the runoff ranged from 6.67 to 19.38 inches, averaging about 12 inches.

Prof. Adolph F. Meyer in his work on 'Elements of Hydrology' says that evaporation and transpiration dispose of 15 to 25 inches of rainfall and the remainder represents runoff which includes seepage and percolation. The latter will be considered under the next sub-title. From the map of the Geological Survey prepared by Henry Gannett, it appears that the surface runoff over different watersheds ranges from three inches in the States east of the Rocky Mountains to 60 or 80 inches in the northern Pacific States. In the Central and Eastern States, it approximates 20 inches. Each watershed, however, must be independently studied to determine its runoff. This varies greatly in the different months and necessarily averages much less than the rainfall. Where the mean precipitation over the upper Mississippi reservoirs was 24.62 inches, the mean runoff was only 3.61 inches and the percolation averaged 14.7 inches. Over the Mississippi watershed it averaged 5.31 inches, or nearly 25 per cent of the rainfall. The rate of runoff to rainfall ranged from 15 per cent in the Missouri Basin to 24 per cent in the Ohio Basin. In Ohio it amounted to 22 inches. At Saint Croix, Wis., it was 9.6 inches, at Roanoke, Va., it was 17.7 inches. In the Yazoo and Saint Francis basins, the runoff was 90 per cent of the rainfall. Over the Connecticut River where the precipitation for nine years averaged 36 inches, the runoff averaged 21.9 inches. From the James River watershed for seven years, it averaged 18 inches. At Tolickon Creek for 24 years, it averaged 26.10 inches. At Tombigbee, Miss., it averaged 17.10 inches, at Sacramento, Cal., it averaged 20.4 inches. Over the Sudbury River, where the precipitation for 25 years averaged 45.4 inches, the runoff was 21.5 inches. In the State of New York it averaged about 45 per cent of the rainfall.

John C. Hoyt and Robert Anderson in their 'Hydrography of the Susquehanna River Drainage Basin,' reported that the runoff in that part of the basin above Harrisburg from 1891 to 1904, averaged from 49 to 55 per cent of the rainfall and at other places in the basin from 49 to 63 per cent of the rainfall. Over the Nashua River where the precipitation for 13 years averaged 47.3 inches, the runoff averaged 23.9 inches. The runoff averages nearly 50 per cent of the rainfall in New England. Over the Croton River, where the precipitation for 43 years averaged 48.9 inches, the runoff averaged 23.3 inches. Over the Milburn-Massapequa watershed, Long Island, N. Y., where the mean precipitation was 46.41 inches the runoff was about 30 per cent thereof. Over the Susquehanna River, where the precipitation for 10 years averaged 38.4 inches, the runoff averaged 21.3 inches. Over the James River in Virginia, where the precipitation for 14 years averaged 42.3 inches, the runoff averaged 17.9 inches. Over the Potomac River, where the precipitation for 14 years averaged 37.4 inches, the runoff averaged 14.4 inches. Over the Muskingum, where for seven years precipitation averaged 41.21 inches, the runoff averaged 14.20 inches. Over the Rock River, Illinois, where the precipitation for five years averaged 33.88 inches, the runoff averaged 10.03 inches. George W. Rafter in 'Water Supply and Irrigation Papers No. 80 United States Geological Survey' gives the runoff for various years over 12 watersheds, and it averaged from one-third to one-half the rainfall.

Over Saale River, in Germany, where for 14 years precipitation averaged 23.78 inches, the runoff averaged 7.17 inches. Over Remsched Dam in Germany, where for nine years precipitation averaged 45.62 inches, the runoff averaged 30.78 inches. Over the Woodburn River in Ireland, where precipitation was 36.29 inches, the runoff was 23.04 inches. Over the Buffalo River in South Africa, where precipitation was 29.52 inches, the runoff was 5.30 inches.

The mean runoff from 20 watersheds in France is nearly 50 per cent of the precipitation, while in Germany the mean runoff from nine watersheds does not, excepting in three instances, exceed one-third the precipitation.

The mean runoff from the watersheds of Great Britain ranges from 50 per cent to 75 per cent of the precipitation. The foregoing data, largely from approved reports, indicate observed runoffs. They are not merely estimates from curves which are fraught with more or less error, owing to the failure in some instances to take into consideration all the necessary physical elements of a given watershed to determine its actual runoff.

The French physicist, G. Lidy, proposed the equation of $P + E + R = R''$, wherein P stands for percolation, E for evaporation, R for runoff and R'' for rainfall, but that does not always accord with actual measurements. Atmospheric and material conditions may so affect the factors of the equation as to make an unbalanced equation.

T. U. Taylor, of the Society of Civil Engineers, well says: "Runoff is a complex factor depending on rainfall topography, vegetation, kinds and condition of the soil at the time of the rains." (Proceedings of the Society of Civil Engineers, Vol. XL, p. 166).

(4) Percolation is the descent of water from rain or snow, or from other sources into the porous strata of the earth due to gravity. Water thus descends to the saturated horizon usually a little above the water-bearing level of the ground water. As the latter is drawn upon by capillarity and ceaselessly flows away between the strata of the earth, it is depleted and the percolating waters replenish the losses. Such "gravity waters" descend, where the soils do not admit of capillarity. Ground waters fill the subterranean channels, supply springs and wells and descend

"Through caverns measureless to man
Down to a sunless sea."

The subterranean Rubicon in Belgium is a river of ground waters.

Ground waters are well nigh unfailing sources of water supplies as we shall see from what follows. As already stated, percolation disposes of what is left after evaporation, transpiration and runoff have eliminated a large part of the rainfall. It is conditioned somewhat upon the physical formation of the territory and also upon climate, temperature, elevation and slope of watershed. On mountain slopes and hillsides, where the surface and strata are tilted, there is little percolation, but excessive runoff. Permeability of the strata determines their storage capacity. Soils, unconsolidated deposits, sands, gravels, sandstones, porous limestones, slate, till, conglomerate quartzite and other rocks absorb quantities of water dependent upon their porosity. The denser rocks, such as granites, gneisses and schists are relatively impervious to saturation and in such geological formations only in joints, faults, bedding planes, caverns and subsurface basins and channels is water collected. The porosity of all these different strata and the physical conditions of the earth's crust largely control the amount and depth of percolation, which ranges in different locations from 10 per cent to 50 per cent of the precipitation.

Into some soils over which the rainfall is 30.29 inches the percolation averages 13.61 inches thereof. On Long Island it was estimated by the Burr-Hering-Freeman Commission to be from 30 per cent to 50 per cent of the rainfall and to range from 15 to 25 inches, conditioned upon the dry and wet years. In Muhlthal, Germany, where the rainfall was 47.1 inches, the percolation was found by Walter E. Spear to equal 30.42 inches. He estimated the percolation in Germany to equal 50 per cent of the rainfall, in Holland to range from 11.1 inches to 15.3 inches of the rainfall and in Belgium to range from 6 to 9.7 inches of the rainfall. Herbert E. Gregory estimated that 25 per cent of the 46.89 inches of rainfall over Connecticut is absorbed in the ground, while in some sections of the United States such absorption is greatest during the period of heaviest rainfall and then it ranges from 80 per cent to 95 per cent of the precipitation. In this manner water enters the strata of the earth and forms underground streams or is collected in springs and in subsurface basins. Such waters are known as ground waters and supply wells and also flow toward river beds and to adjacent waters, such as lakes, seas and oceans. Ground waters are also supplied from streams flowing over the surface. Large habitable areas are supplied from underground flow by means of innumerable wells, tapping that flow, or by means of springs or by means of conduits, as on Long Island, or by means of infiltration galleries, as in some parts of Belgium, Holland and Germany.

I. M. de Varona found that the amount of ground water recovered from Ridgewood drainage area of 65.4 square miles in 1890, when the rainfall was 52.15 inches, was 17.68 inches, which was 33.9 per cent of the former. For several years in that area such amount ranged from 28 per cent to 33 per cent of the precipitation. The Board of Water Supply estimated that, if the Ridgewood watershed were completely developed, the yield of ground waters in normal rainfall years would be nearly 1,000,000 gallons a day for each square mile of area. They reported that the old watershed was yielding 900,000 gallons a day per square mile and the new one was yielding 700,000 gallons a day per square mile. The Burr-Hering-Freeman Commission from its investigations concluded that, in addition to the water being pumped in 1903 for Brooklyn, there might be obtained 200,000,000 gallons per day from the southern watersheds of Long Island.

The underground reservoirs of California are structural basins filled with the alluvial debris, due to the weathering of the adjacent mountain ranges. Through such alluvial deposits precipitation percolates to the impervious rock below. The ground waters are thus collected and their only escape is through some possible subterranean or known surface channel, evaporation or springing or seeping through the overlaying deposits at the lower side of the tilted, but elevated, basin. Such ground waters may be used and in some mountain localities are being drawn and conducted to irrigate desert areas and to supply needy communities with wholesome waters.

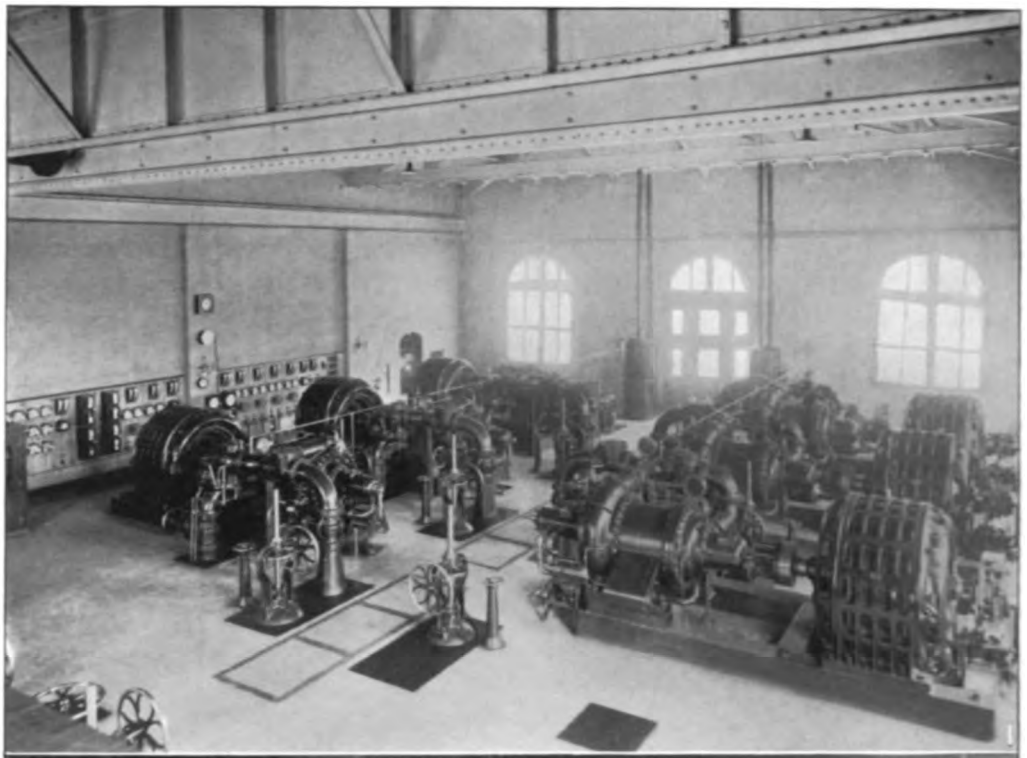
The report of the State Water Conference of California in 1916 shows that many of California's water problems were considered and recommendations made for drawing upon the ground waters in the San Joaquin and Sacramento valleys and elsewhere to irrigate the arid lands where there is insufficient precipitation to make such lands productive and also to supply waters for municipal purposes.

The extent and quality of some ground waters are shown in the Water Supply Papers of the United States Geological Survey as follows: for Connecticut in Paper 232, for Kansas in Paper 273, for Iowa in Paper 293 and for Owen Valley, California, in Paper 294.

Some of the legal principles applicable to ground waters in Europe and America are stated in Bradford Corporation v. Ferrand, 2 Ch. 655; also fully reported in two British Ruling Cases, 980; The People v. New York Carbonic Acid Gas Co., 196 N. Y. 421; Lindsley v. National Carbonic Acid Gas Co., 220 U. S. 61; and in the annotations to the first of said cases and in the other cases referred to in said cases. Consult 'Water Supply and Irrigation Paper No. 122,' United States Geological Survey.

The Board of Water Supply of New York reported in 1912 that the Brussels watershed of 4.6 square miles yielded 2,100,000 gallons a day; that The Hague sand dune catchment area of 7 square miles yielded 5,100,000 gallons a day; that the Amsterdam sand dune catchment area of 11.6 square miles yielded 6,100,000 gallons a day, and that the Muhlthal watershed of 14.7 square miles yielded 21,300,000 gallons a day.

These few records indicate the large quantities of ground waters obtainable from the watersheds mentioned for water supply purposes. They also indicate the quantities of percolation into the strata of the areas described. They also indicate the amount of water stored in the earth's strata for water supply purposes. Some of the ground waters, however, find their way to the surface by seepage through sands and gravels, emerging in ponds, streams and springs. Such seepage is the outflow through



1 High Pressure Fire Service Pumping Station, New York

2 Water Laboratory, New York

the surficial layers of ground waters flowing downward from the water-tables above. Wherever the ground water level is higher than the surface or depressions in the surface, the water "seeps" through the sands and gravels and appears as already stated. This is noticeable in marshy areas in the period of heavy rainfall and also in the many mineral and other seepage springs found in mountainous districts as well as in such streams as those on Long Island. The amount of ground water thus returned to the surface is but a small percentage of the volume of underflow, the amount and rate of which in some localities have been determined and reported by Charles S. Slichter of the Geological Survey. The winter flow of Minnesota streams is largely seepage waters.

Ground waters are being continuously replenished by percolating waters coming from precipitation, the amount of which the world over must be known to ascertain the volume of surface and ground waters available for the water supplies of the inhabitants of the earth. They are also replenished to some extent from surface waters in some regions.

Percolating waters descend to the surface of the saturated strata and become part of the permanent ground waters of the region. The saturated strata known as "water-bearing formations" are several hundred feet in thickness and overlie the strata that are impervious to water. The surface of saturation is known as "the ground-water level" and may be within a few feet of the surface. Above this saturation is not constant. Hence, to insure a continuous supply, wells must be deep enough to reach the ground water level, and as that fluctuates in different regions and in the wet and dry seasons, it is necessary to drive wells some distance below the level. From the several water horizons, comprising strata, consisting of different geological formations, various qualities and quantities of water are obtainable. Geological and water supplies reports of this and other countries may be consulted for specific information in relation to the nature of the ground waters of any region covered in such reports. Myron H. Fuller and others of the United States Geological Survey have compiled much valuable data on the ground waters of the United States of America. From their reports as well as from others it appears that the water-bearing horizons are not always horizontal, but incline either up or down in most watersheds, and the force of gravity causes a flow of ground waters between the layers of such horizons, "mainly," says Herbert E. Gregory, "in the same direction as the slope of the surface." Such flow is very slow, being from a few feet to a mile or more a year, depending on several conditions, such as character of the water-bearing formations, temperature, slope, percolation and other physical elements. The flow, however, is continuous and replenishes wells, springs and streams, as they are drawn upon, or otherwise discharge their waters. Springs and flowing wells exist in Connecticut, Michigan, Iowa, California and elsewhere. These and thousands of other wells in all lands are fed from the inexhaustible ground waters of the earth to supply human needs. Copenhagen draws its entire supply from wells down through glacial drift to chalk deposits.

Some of these may be hereinafter mentioned, as they are the principal sources of the water supply of most rural populations.

Water supplies are obtained from waters that run off from catchment areas and from waters that percolate the strata of the earth. Before considering any particular water supply and a few only need be considered as they are necessarily local and special in their characteristics, may be considered the important matter of the purification of water supplies. That subject is of general interest to all communities.

Purification of Water Supplies.

Introduction.— This is so important that it must be considered at some length and under several subheadings. Enough has already been said to show that nearly all waters in their natural or raw state are unsuitable for potable uses, but most unpolluted surface waters may be rendered wholesome. Under this subtitle some of the processes in use for that purpose will be described.

Purification of water supplies is no longer effected by the lyre of Empedocles as stated by Matthew Arnold, whose music did

> "Cleanse to sweet airs the breath of poisonous streams."

Absolute self-purification of running waters has not been conclusively demonstrated, though partial purification is undoubtedly effected. (Consult Phelps, Earle B., 'Studies on the Self-Purification of Streams,' United States Public Health Service). Where oxygen from the air is dissolved in water oxidation of organic matter takes place and bacteria in time are destroyed provided such running water be not further polluted by sewage and other contaminating refuse. Where waters are covered with ice and oxygen is excluded therefrom, there may be an increase in their bacterial content. Prof. H. Marshall Ward has reported that the blue and violet rays of sunlight destroy bacteria near the surface but have little or no effect upon the germs a few feet below the surface. In darkness some genera are propagated. The *B. coli communis*, *B. typhosus* and others will live several days in running water and multiply therein, if there be waste material thrown into it.

To aid natural purification, "filter wells," "filter galleries" and "filter cribs" have been installed at some places in West Virginia, Pennsylvania, Indiana, Ohio, Massachusetts and elsewhere, which are of doubtful utility for they merely clear the water of visible pollution, while they may concentrate the bacteria and promote their propagation.

Polluted waters percolating into some soils are subjected to nitrification, which William P. Mason describes, as the tearing asunder of the objectionable nitrogenous organic materials, securing their union with the oxygen of the air and thus converting them into harmless inorganic forms. The action of nitrifying bacilli is mainly confined to upper layers of soil. Mason on 'Water Supply,' p 221

George A. Johnson of the United States Geological Survey says in his valuable Water Supply paper that "a majority of the cities and towns of the United States take their water supply from ground sources . . . and as a rule they are pure, clear and colorless, although they are very hard and others

contain much iron in solution." Recent bacteriological and microscopic examinations, however, show many ground waters and consequently wells and springs are not wholly free of pathogenic bacteria. All waters collected for potable purposes ought to be tested before they are used. Most of them in their natural state contain micro-organisms, some of which are pathogenic and others are harmless as stated by Dr. Maximilian Marsson of Berlin in his lectures on "The Significance of Flora and Fauna in Maintaining the Purity of Natural Waters." Each water supply from whatever source ought to be tested before use. Iron is found in the ground waters of Germany, Holland, the Netherlands, Britain, the United States and elsewhere.

In his valuable work entitled 'The Purification of Public Water Supplies,' John W. Hill, at page 278, says "the dimensions of the bacteria (*B. typhosi*) are stated in microns, designated by the Greek letter μ, which is 1/1000 millimeter, equal to 1/25000 of an inch. Thus the typical dimensions of *B. typhosus* are .5 to .8 μ wide, by 1.5 to 2.5 μ long, or about 1/50000 to 1/31250 of an inch wide or thick and 1/16666 to 1/10000 of an inch long. Taking the average length of the typhoid bacillus as two microns (μ) it would require 12,500 of these placed end on end to make an inch."

All such bacteria are invisible and may be detected only by some one of the modern scientific tests. (Consult Hasseltine, H. E., 'The Bacteriological Examination of Water,' United States Public Health Service). Some bacteria are non-pathogenic and, with such knowledge as we now have of their characteristics, are considered harmless, while others are themselves destructive of lower bacteria, as are the *Rotifera*. Bacteriologists are studying these lower forms of life to determine their nature and activities in relation to other forms of animal life and are making new discoveries from time to time of vital importance to the welfare of the race.

Bacteria and Other Micro-organisms in Water.— Migula undertook to classify all bacteria into five families, namely, (1) Coccaceæ, (2) Bacteriaceæ, (3) Spirillaceæ, (4) Chlamydo-bacteriaceæ and (5) Beggiatoaceæ.

That grouping is still maintained by some bacteriologists. Other and additional families have also been suggested. Some species are pathogenic. Some bacteria already localized are *B. acrophilum*, *B. alcaligenes*, *B. anthracis*, also known as the *microspira comma bacillus*, the cause of anthrax, or splenic fever, *B. clocæ*, *B. coscorobæ*, *B. coli communis*, under certain conditions pathogenic, one of the widely disseminated microbes, *B. communior*, *B. cuticularis sporogenes*, *B. diphtheriæ*, *B. enteritidis sporogenes* in sewage, *B. influenzæ*, *B. lepræ*, *B. pestis*, causing Bubonic plague, *B. prodigiosus*, *B. ruminatus*, *B. salmoni*, causing hog-cholera, *B. shigæ*, found in cases of diarrhea, dysentery and cholera infantum, *B. simplex*, *B. streptococci*, *B. subtilis*, *B. tuberculosis*, *B. tumescens*, *B. typhosus*, *B. welchii*, *M. agilis*, *P. miribilis*, *B. vesiculosi* and others.

Nearly all of these subsist in natural and polluted waters and increase rapidly under favorable conditions. Thousands of some of them have been found in a single cubic centimeter of raw water. They are found in natural, unpolluted pools, brooks and ponds in rural and even in mountain regions. From official reports it may be seen how prevalent they are in nearly all waters and the processes that are being adopted to eliminate or destroy them. Some of these will be considered in this article. In 1906, S. D. Gage concluded that they propagate more rapidly in warm weather than they do in cold weather. Millions of some species have been found in a cubic centimeter of sewage, thus showing the danger of pollution therefrom.

In addition to the bacteria proper are the innumerable micro-organisms, comprising both animal and vegetative growths in drinking water. Prof. George C. Whipple has described and enumerated in his 'Microscopy of Drinking Water' 200 or more of such species. He has classified vegetative organisms into such groups as (1) Diatomaceæ, (2) Schizophyceæ, comprising Schizomycetes and Cyanophyceæ, (3) Algæ, (4) Fungi and (5) various higher plants. Under Diatomaceæ is the species Asterionella, which infested Mount Prospect reservoir in Brooklyn in 1897 and necessitated its non-use until they could be removed.

He has classified the animal micro-organisms into (1) Protozoa, comprising rhizopoda, mastigophora (flagellata), and infusoria; (2) Rotifera; (3) Crustacea, comprising entomostraca; (4) Bryozoa; (5) Spongidæ, and (6) various higher animals.

Other sanitary engineers, biologists and bacteriologists have localized and classified other species, of which these may be legion. Some of these have been studied and subjected to various tests to determine their characteristics and their effect upon water and water supplies. Some live but a short time, while others live for days, weeks and even months. Some after brief existence die and impart a disagreeable taste or an offensive odor to water. Some genera are pathogenic, that is they produce disease in human beings and other genera are harmless, so far as known at the present time.

Prescott and Winslow in their 'Elements of Water Bacteriology' describe still other characteristics of some of the countless colonies of animalcula infesting the surface and ground waters of the earth. Bacteria are found in shallow wells and even in deep well waters. Prescott and Winslow found them in deep wells and springs in Worcester, Waltham, Hyde Park, Mass., in Newport, R. I., and at Saranac Lake, N. Y. They have been found in well waters at Mainz, Leitmeritz and Kiel in Germany and elsewhere. Quantitative bacteriological examinations and the microscope are now revealing bacteria in many waters not detected by any of the tests formerly applied, and that may account for the failure to discover them. Consequently bacteria in ground waters escape detection and such waters were formerly considered pure and wholesome. "Even rain and snow," say Prescott and Winslow in their 'Elements of Water Bacteriology,' "are by no means free from germs, but contain them according to the amount of dust present in the air at the time of the precipitation. . . . Janowski, in 1888, found in freshly fallen snow from 34 to 463 bacteria per cubic centimeter of snow water. . . . It is

difficult to find a river in inhabited regions, which does not contain several hundred or thousands of bacteria to the cubic centimeter.»

In ground waters are found such microscopic organisms as *crenothrix, cladothrox, lepothrox, asterionella, anærobia* and typhoid bacteria. The latter were reported as occurring in some ground waters in Germany, probably due to surface pollution. Still many communities obtain their supply from surface waters such as springs, streams, rivers, ponds and lakes, all of which are fed primarily by the waters and snows, precipitated over the earth's surface to the extent already shown. Most of said waters are consumed in their natural state without purification by filtration, sterilization or otherwise. As already stated, it is a well-known fact that most surface waters are unsafe for potable uses. Such waters are frequently polluted by the inflow of sewage and become the purveyors of deadly organisms.

The investigation of the pollution and sanitary conditions of the Potomac watershed under the supervision of the United States Hygienic Laboratory reported in Bulletin No. 104 disclosed 20 or more genera of living organisms, including *bacilli coli communes* in great quantities. Spore-forming *anærobia*, gas producing organisms, were found in parts of the river unpolluted by sewage, thus proving that those living organisms may be found in any surface waters. The biology of rivers has been treated by Dr. S. A. Forbes, Prof. R. E. Richardson and others in this country and by Dr. A. C. Houston in his 'Report on Research for The Metropolitan Water Board of London' and by W. G. Savage of England. The American Public Health Association in its report on 'Standard Methods of Water Analysis' in 1912, suggested tests to discover bacteria in water. Typhoid fever and other deadly diseases may have their inception from the bacteria in such unwholesome waters. It is, therefore, of vital importance to all communities, that they be provided with pure water supplies. This may be accomplished by treating such waters in a manner to rid them of bacteria and all other foreign organisms. Other bacteria will be mentioned under the several processes for their elimination.

The general acceptance of "the germ theory of disease" led to investigation into the media of transmission of pathogenic microbes. Potable water was found not only to be a purveyor of such bacteria but a medium for their propagation. The epidemic of Asiatic cholera in Europe in 1847 and in 1850 has since been attributed largely to contaminated water supplies. The British Parliament, suspecting that such might be the case, in 1852 passed its first act requiring the filtration of the Metropolitan Water Supply. Later Dr. Robert Koch actually discovered the cholera bacillus (*B. choleræ Asiaticæ* or *comma bacillus*) and found that it would exist for some time in water. He thereby demonstrated that cholera might be spread through water supply of communities, as it appeared to have been spread during the epidemic of 1847 and 1850. Upon the surface of an open sand filter at Boston six genera and four and one-third million organisms were found in one square centimeter of sand. All were not pathogenic but some are an aid to filtration. However when the decomposition of such organisms in water sets in, it may impart offensive odors. These have been grouped as aromatic, grassy and fishy, thereby indicating the genus undergoing decomposition and disclosing the character of pollution.

The most numerous and prevalent pathogenic microbes found in American and foreign surface waters are the typhoid bacilli, which caused a death rate of 23.3 per 100,000 population in 48 cities of the United States in 1910. That is four times the death rate per 100,000 population in Berlin, Vienna and London from typhoid fever per annum. But the death rate from typhoid in America is being lowered, as greater efforts are being made to secure pure waters for municipal and general potable purposes. Fortunately for rural populations most of their supplies are from ground waters, which are free or largely so from bacteria, except where such ground waters are near enough the surface to be polluted.

Dr. Koch discovered a method of eliminating bacteria from surface waters, which was to allow the water to percolate through slow filters. Those were found to remove most of the microbes from the water as it percolated through such layers of sand and gravel. A single filter, however, did not always arrest all the living organisms in the water, so that two or three sand filters came into use. The filter beds at first are not wholly impervious to the transmission of bacteria. It was learned from experiments that the surface must first be coated with a film of mud and microbes before the latter were entirely arrested. When such a film is completely formed over the surface of the layer of sand, then the filter is efficient and may be kept in operation as long as water continues to percolate through it. Then its layers may be washed by drawing off the water standing in the basin and by forcing filtered water up through the layers of sand and of coagulated matter. While the filtered water is being so forced up through the layers, they and the coagulated matter thereon may be agitated by raking as is done in the works of Pittsburgh, or they may be agitated by mechanical devices. In this manner the coagulated matter is lifted and freed from the surface of the sand. Filtration may then be resumed. This may be repeated once or twice before it is necessary to scrape off the coagulated matter and the upper layer of sand to the depth of one or two inches, which is all that is necessary to remove, in order to dispose of the pathogenic microbes and other foreign bodies and the mud and silt. The layers of sand so removed may then be cleansed, dried and replaced in the filter basin and filtration may be resumed. There are various methods of renovating sedimentary and infiltration basins, but the foregoing methods illustrate some of the processes in general use. It is a well-known fact that bacteria propagate rapidly and there is always a possibility that some may pass through a filter and contaminate the water that has passed through such filter.

The processes in general use for the purification of water include: (1) Sedimentation with or without chemicals; (2) preliminary treatment for slow sand filters; (3) slow sand filtration; (4) rapid sand filtration; (5) the dis-

infection of water supplies by various chemicals; (6) the application of (a) ozone, or (b) ultra-violet rays of light, and (7) by sterilization. Two or more of these processes may be used in succession in the same plant, or they may form parts of a single system though operating independently of each other.

In the application of these processes many subsidiary details are involved and the completed waterworks of a city are often its most costly, complex and elaborate public works.

A brief description of each of these several processes for the purification of water may show something of their value and adaptability to the services which they are required to perform in rendering water suitable for domestic and potable purposes.

1. Sedimentation is the clarification of turbid or of other waters holding particles of foreign matter in suspension. This may be aided by the introduction of such chemicals as tend to promote coagulation of the particles in suspension in the water. Sedimentation is the process used in the removal of such large particles as are found in the waters of the Hudson above Poughkeepsie, in those of the Potomac above Washington, in the Ohio above Cincinnati and Louisville and in the Mississippi above New Orleans, in all of which cities sedimentation reservoirs and coagulation basins are in use. The process removes most of the colloidal material in suspension. Percy Frankland found that sedimentation removed 82 per cent of the bacteria in the Grand Junction Company's reservoir and about 87 per cent of the bacteria from the water that had passed through to storage reservoirs of the West Middlesex Company. Official reports show that from 87 per cent to 97 per cent of the bacteria were removed from the waters after 32 days subsidence in the reservoirs at Cincinnati and Covington; Dr. A. C. Houston reported to the London Metropolitan Board that "thirty days' storage of river-water is tantamount to sterilization" as to pathogenic microbes. William P. Mason, however, states that "bacteria sink but slowly in water." If that be so, a long period of subsidence is necessary to make sedimentation an efficient process for their removal from water supplies.

2. The preliminary treatment of water for slow sand filters may be affected by the use of sulphate of lime to coagulate the clay particles in suspension as in the Potomac, or by the use of concrete sedimentation basins with roughing filters of coarse stone, called baffles, to strain out the coarser materials in some waters coagulated by the introduction of chemicals and removed therefrom before the water passes into the sedimentation basins, as in the filtration plant at Pittsburgh, or still by the use of such preliminary filters without coagulation, as those of the Torresdale type in use at Philadelphia, where since their installation it has been found necessary to install a sedimentation basin for the use of coagulants on account of the large quantity of turbid waters to be treated, or still by the use of such prefilters as those described by William F. Johnson, in the Puech-Chabal system extensively used in Europe. That system consists of a series of decreasing in size roughing filters, a subsiding basin and a coagulating basin.

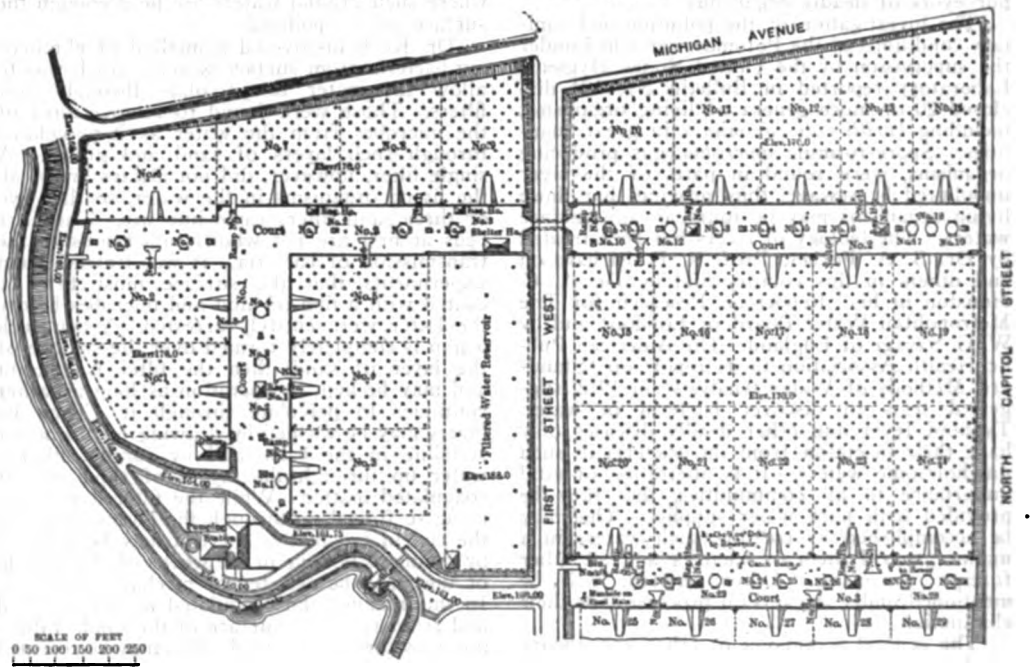


FIG. 1.—General Plan of Filtration Plant, Washington, D. C.

3. The slow sand filtration process is in use in Washington, D. C. A large area of sand is required and many water-tight basins of sand are necessary, where a large volume of water is to be clarified. The Belmont and Queen Lane filters of Philadelphia are of this type and comprise many shallow sand beds underlain with layers of gravel. Such filters

have masonry or concrete walls and are covered over where necessary to prevent freezing. Philadelphia has five slow sand filtration plants, known as the Upper and Lower Roxborough, Belmont, Torresdale and Queen Lane plants, with an aggregate daily capacity of 405,000,000 gallons, the largest in the world. Some of these have settling basins, sedimentation basins, covered preliminary filters, filtered water reservoirs, the Torresdale plant of 240,000,000 gallons daily capacity having 120 covered mechanical preliminary filters. Philadelphia obtains its supply from the Schuylkill and Delaware rivers and the latter is becoming so polluted, that other sources may be required. The arrangements there for treating water with chemicals were elaborate and it was necessary to use chlorine, for the Torresdale filters did not remove all the bacteria.

From Hugh S. Cumming's 'Investigation of the Potomac Watershed,' it appears that the District of Columbia obtains its supply of water from the Potomac River at Great Falls 150½ feet above tide-water. The water is conducted through a circular conduit nine feet in diameter most of the 15 miles distance by gravity to the Dalecarlia, Georgetown and McMillan Park reservoirs, from the latter of which the water is pumped up 21 feet to the slow sand filtration plant, one of the best in the country, comprising 29 filters, each having an area of an acre, altogether having a daily capacity of upwards of 100,000,000 gallons. In the Georgetown reservoir the water is sometimes treated with sulphate of aluminum, used as a coagulant to assist sedimentation before slow sand filtration and in some cases it is used where no filtration is employed.

Plants for supplying such preparation of alum as a coagulant have recently been installed at Trenton, N. J., Springfield, Mass., Columbus, Ohio, and at Omaha, Neb. Slow sand filters were used by the Chelsea Water Company of London in 1829 to remove turbidity from water. As now constructed their daily capacity is from 2,000,000 to 3,000,000, and in some exceptional cases as high as from 6,000,000 to 8,000,000 gallons per acre. When they become clogged, as they necessarily do, then the coagulated deposit is removed. Then the superficial layers of sand from one-half to one and one-half inches in depth are scraped off, then washed and dried and replaced. There are several means for sand washing, including the Nichols separator, the Blaisdell filter sand-washing machine and surface raking, which increases the efficiency of the process of slow sand filtration. In all such plants at least 12 inches of sand must be maintained and from two to three feet of sand is much more efficient. Many cities and villages are using the slow sand filtration process for the filtration of water, including New Orleans, Pittsburgh, Superior, Zurich, Yokohama and Osaka, where in 1905, the bacteria were reduced from 200 to 25 per cubic centimeter, while at Lawrence, Mass., the bacteria in the Merrimac River water were reduced from 12,700 to 70 per cubic centimeter as a result of the installation of the slow sand filtration plant there in 1893. The chlorine disinfection of that water was reported on by Clark and Gage in 1909, showing the reduction of bacteria at different temperatures of the water. Such plants are at Albany, N. Y., and at Wilmington, Del., and many are in use in Europe. Some of them are equipped with automatic controllers. The rate of filtration is slow and the filter must be cleaned and that is done by scraping off the superficial layers of sand and then washing, drying and replacing them. Allen Hazen says that "sand filtration alone, without preliminary treatment, is able to remove nearly all of the objectionable bacteria, as well as other organisms, from many waters, at the same time purifying them in other ways." The bacterial content of the filtered water is very low, but not entirely free from organisms. It was on the report of James P. Kirkwood of his investigations in Europe in 1866, that Slow Sand Filtration plants were subsequently constructed at Poughkeepsie, Lowell, Columbus and Toledo.

4. Rapid sand filters, by some also denominated mechanical filters, require less area than do the former type, but they are more elaborate and somewhat complex in construction. Typical plants comprise pumping stations, preliminary settling basins, coagulation basins for the treatment of the waters by chemicals, chemical rooms and mixers, filter tanks with connecting pipes, cleaning apparatus, controlling mechanism, covered reservoirs for the filtered water, a drainage system and other equipment to meet existing conditions, as to locality, characteristics of raw water and amount of filtered water desired. Filters of this type will clarify 125,000,000 gallons of water a day per acre of its turbidity and of 90 per cent to 99 per cent of its bacteria. Strictly modern rapid sand filter plants under skilful management with the proper use of germicidal chemicals are nearly 100 per cent efficient in the elimination of all bacteria from ordinary running surface waters. Some waters, however, carry in solution an abnormal amount of foreign substances and those may partially neutralize the germicidal agents of the usual dosage and in such cases the bacterial content may not be entirely negligible. In such cases the foreign matter may partially consume the disinfectant, so that some of the bacteria may escape and appear in the effluent. Such effluents may then be treated with chlorine, which will destroy the remaining bacteria, unless they be of a class immune to such treatment.

Rapid sand filters of the improved type are in use in Little Falls, N. J., Cincinnati, Columbus, Cleveland, Youngstown and Toledo in Ohio, Louisville, Ky., Saint Louis, New Orleans, Harrisburg, Minneapolis, Baltimore and elsewhere. The Cincinnati, Louisville, New Orleans and some others also have preliminary settling basins, where the suspended colloidal matter in the water settles. The water is then drawn off into the coagulation basins and therein coagulation is effected by the introduction of common alum, or aluminum sulphate alone or with caustic lime or ferrous sulphate (copperas) or other chemical coagulant. When brine is used in some cases caustic alkali is also needed.

Joseph W. Ellms, author of 'Water Purification' states that "such electrolytes as acid basis and salts will coagulate colloidal suspensions and so will hydrochloric acid, caustic soda, caustic lime or ordinary salt solutions." In that manner all organic matter including bacteria and inorganic matter suspended in the

water are entangled and deposited on the layer of sand at the bottom of the basin. The bacteria and colloidal matter so deposited form a coating, or film over the surface of sand impervious to bacteria and other suspended matter but not so to water, which flows rapidly through it. Many devices serve to facilitate the operation of that process of the purification of the raw river waters, which are the source of supplies for such cities.

Rapid sand filtration operates rapidly, owing in part to the reverse flow of water through the sand, which flow washes away the accumulation of coagulated matter and bacteria into the drainage pipes. Several hundred cities are using this process for the purification of their waters, including many foreign cities. The bacteria in the Polar River water at Bethmangalia, India, were reduced from 4,350 to 13 per cubic centimeter.

The construction and operation of the rapid sand filtration plant at Baltimore will suffice to illustrate that process of purification of water supplies.

Baltimore formerly obtained its water supply from Gunpowder River, collected into Loch-Raven and from Jones Falls collected into Loch Roland. Both sources were polluted by pathogenic bacteria, including *B. typhosi* and *B. coli communes* in great quantities.

Baltimore still obtains its principal water supply from the new impounding reservoir at Loch Raven, which has been enlarged by a new dam 48 feet above the bedrock. The water is drawn through a tunnel 12 feet in diameter into Lake Montebello and from that lake it is pumped through a venturi meter, an ærator gate house, head house with tower 80 feet high containing chemical storage bins, a mixing basin, coagulating basins and thence to the filters. The design involves the handling of wash waters in the settling reservoirs, a drainage system, effluent pipe details, a head house, a pumping station, a baffle mixing chamber, two coagulating basins, covered filtered water reservoirs and other equipments.

A nine-foot conduit, recently built, connects the Montebello reservoirs with the distributing system at Lake Clifton. Altogether the Baltimore new mechanical filtration plant, also known as the rapid sand filter, at Lake Montebello, has 32 units, each with a capacity of 4,000,000 gallons daily.

5. The disinfection of water supplies by various chemicals. In 1774 the Swedish chemist, Karl Wilhelm Scheele, made an analysis of manganese dioxide and from that he was led to the discovery of chlorine. Hydrochloric acid, consisting of chlorine and hydrogen, was isolated by J. Priestly in 1772. Chlorine depends upon the oxidation of that acid, whose salts are known as chlorides. In 1800 chlorine was used as a disinfectant in France and in England. In 1854 it was used in London to deodorize sewage. Another chlorine disinfectant was Eau de Javelle made by Percy, near Paris in 1792, also known as Labarraque solution, chloros and chlorozone, according to Joseph Race. The germicidal nature of chlorine, however, was not understood until after the discovery of living organisms in water. Experiments were made with chlorine in France, England, Germany and in the United States. In 1890 a plant was erected for its manufacture at Bradford, England, and in 1893 one was erected at Brewster, N. Y., and "electrozone" was applied to the sewage then polluting the Croton water supply. Dr. A. C. Houston of London is said to be the first to apply chlorine to the purification of water. The history of disinfectants now very widely and generally used is given to show the slow progress made in the evolution of such agencies for the purification of water supplies. Had chlorine been in general use within half a century after its discovery, the appalling mortality in London in 1854, due to cholera, and in Germany in 1892-93, also due to cholera, might have been avoided.

The chemicals now in use as such disinfectants are liquefied chlorine gas, calcium hypochlorite or bleaching powder, sodium hypochlorite, copper sulphate in minute quantities, sulphate of ammonia, sulphate of iron, caustic and hydrated lime, carbonate of soda, chloramine and possibly others or compounds of some of these. Most of these germicides are of recent discovery and their application to water supplies has necessitated the renovation of most of the water plants of this and other countries. Since the proposal of Webster in 1889 to use electrolyzed sea-water as a disinfectant, several processes have been utilized for the transmission of a current of electricity through some of the foregoing and other substances to produce coagulants and disinfectants.

In 1859 James Watt discovered that hypochlorites were produced by the electrolysis of the chlorides of alkalies and alkaline earths.

Joseph Race, in his 'Chlorination of Water,' p. 106, maintains that in the electrolysis "of the solution of sodium chloride, the chlorine may combine with the sodium hydrate formed by the action of the sodium on the water to form sodium hypochlorite, one-half of the chlorine produced is found as hypochlorite and the other half reforming sodium chloride. . . . The electrolytic hypochlorite method offers some advantages, but in the great majority of plants it cannot economically compete with bleach."

Commercial bleaching powder is formed by passing chlorine gas over slacked lime. It is also known as calcium hypochlorite and as stated by Joseph W. Ellms in his 'Water Purification,' p. 369, consists of several chemicals formed by the reaction of chlorine and calcium, such as calcium oxychloride, calcium chloride, calcium chlorate, calcium hydroxide, calcium carbonate, calcium sulphate, oxides of Na.K.Mg.Fe and Si. and moisture. These undergo reactions resulting in the evolution of oxygen which is set free and is destructive of micro-organisms. Oxygen is the potential energy that destroys them.

Calcium hypochlorite was first used effectively in this country to purify the waters of the Benton reservoir at Jersey City of bacteria. Since that it has been and is still extensively used as a disinfectant. Its germicidal energy is said to equal ozone as an oxydizing and sterilizing agent, and is much cheaper than ozone.

Hypochlorite of sodium, obtained by the

electrolysis of salt, has some advantages over hypochlorite of calcium, which produces sludge, that clogs orifices and is dangerous to fish, when dumped into running waters.

Joseph Race, in his 'Chlorination of Water,' p. 17, says that "on dissolving bleach in water the first action is the decomposition of calcium oxychloride into an equal number of molecules of calcium hypochlorite and calcium chloride." At page 20 he says: "The addition of small quantities of sodium chloride (0.1 per cent) increases the hydrolysis of bleach solutions but much larger quantities tend to the opposite direction . . . . Sodium chloride in the absence of hypochlorites was found to have no influence upon the viability of *B. coli* in water."

Bleaching powder is one of the most efficient germicidal agents. The neutralizing chemical for an overdose of bleaching solution is sodium thiosulphate at one-half the amount of the former.

F. Raschig, Samuel Rideal and Joseph Race have developed the new germicide, known as chloramine (NH_2Cl), formed by adding ammonia to bleaching solution, which increases the germicidal action of the latter. Joseph Race has stated that from numerous experiments he concluded that the most efficient proportion of the compound was two parts by weight of chlorine to one part by weight of ammonia. Consult Race, J., Chlorination of Water' (p. 118).

On a recent inspection of the operation of the chloramine process at Ottawa, the author learned that the after-growth noted after the use of hypochlorite in some plants amounting to 20,000 bacteria per cubic centimeter has been eliminated and that the *B. coli communes* had been nearly all destroyed. Race reported that similar results followed the application of chloramine at the Capitol Hill reservoir in Denver, where bacteria dropped from 15,000 to 10 per cubic centimeter. It is important to the health of a community that some process be adopted that will eliminate or destroy pathogenic bacteria, so that less than 100 bacteria per cubic centimeter survive whatever process of purification that community may adopt. Otherwise, its water supply is not of that degree of purity which hygienic standards require for potable uses. Such standards have been greatly raised in the last half century, and no enlightened community would be suffered to use such water supplies as were in general use before the nature and characteristics of the micro-organisms in such waters were discovered and partially understood. Therefore the modern processes for the purification must be efficient, and to be so they must conform to scientific standards. Communities will not be permitted longer to provide water laden with pathogenic microbes, and if any one of the foregoing processes of purification fail to eliminate or destroy such organisms, then it ought to be superseded by the installation of a more efficient process, as was done at Ottawa by the substitution of the chloramine in place of liquid chlorine.

Lieutenant Nesfield of the Indian Medical Service is said to have used liquid chlorine gas as a disinfectant of water in 1903. Since 1910 liquified chlorine gas has been used in several cantonments of the United States army and at Wilmington, Philadelphia, Brooklyn, New York and in many other places. On the Western Front during the Great World War it was successfully applied by means of liquid chlorine machines. The Dunwoodie chlorinating plant for New York City has a daily capacity of 400,000,000 gallons. The chlorine gas is introduced into the water in the aqueduct as it leaves the Kensico reservoir to ensure practical sterilization of the water before it reaches the city of New York. This process has some advantages over the hypochlorite or ozone process, though there is danger of injury to operators from leakages of the gas, which is injurious to the lungs and deadly if inhaled in concentrations of .06 per cent. The relative efficiency and cost of installation of these several processes are usually considered before any one is installed. Recently halazone ($Cl_2N{\cdot}O_2S{\cdot}C_6H_4{\cdot}COOH$) has been found to be an efficient chemical for sterilizing heavily polluted waters.

6. The Application of (a) Ozone, or (b) Ultra Violet Rays of Light.—(a) "Ozone is produced," says Allen Hazen in his 'Clean Water and How to Get It,' p. 101, "by the discharge of high-tension electricity through air under certain conditions. The air is afterward pumped through the water to be treated or otherwise the water is showered downward through towers in which the ozonized air is circulated." Ozone, being a modification of oxygen, is a more active oxidizing agent than oxygen and is a powerful disinfectant. There are many devices for the application of ozoned air to the purification of water, but the process is equally efficient but more expensive than the application of the chemicals hereinbefore described. The De Frise system at Saint Maur gives satisfaction in sterilizing the Marne water after sedimentation and filtration. Sanitary commissions, health authorities and specialists have extensively experimented with it in Europe and found ozonized air, when properly applied, was destructive of bacteria in water. The application of the ozonized air produced by the ozonizers, of which there are several in use, such as the large plant of 128 Siemens and Halske ozonizers at Petrograd, with five sterilizing towers, is as follows:

The ozonized air enters the bottom of water towers and is absorbed by the water as it descends through the layers of gravel in some and sieves in other towers after the water has first passed through sedimentation and preliminary sand-filter basins. Such water as it enters the sterilizer may still contain several hundred bacteria per cubic centimeter. The pathogenic bacteria, such as typhoid and cholera microbes, are destroyed by ozonized air, though the more hardy and harmless ones may escape destruction. In the higher towers, the sterilizing ozonized air is injected at several levels, as at Ginnekin, Holland, where all pathogenic bacteria are destroyed. The process is more costly than the hypochlorite process, but it has been pronounced by an English expert as "ideal." It is in use in Brussels, Ginnekin, Paris, London, Berlin, Petrograd, Florence, Chartres, Nice, Saint Maur, Wiesbaden, Paderborn and in many other European cities, and at one plant in Philadelphia and in Ann Arbor, Herring Run, Md., and a few other places, but it is not at present extensively used in America. It has some advantages over the chlorine processes. The Otto process in use in Nice purifies 5,000,000 gallons daily. Its general

use in Europe, after most thorough tests as to its efficiency, may result in its more general use in America.

(b) Ultra-violet rays of light. One of the recently discovered processes for the destruction of pathogenic bacteria is the application of ultra-violet light to the flow of water through flumes, so that the organisms are exposed to the concentration of its rays. Several ultra-violet ray sterilizers have been devised and successfully used in the rapid destruction of bacteria. It was demonstrated, by experiments made by Henri Helbronner and others at Sorbonne University in Paris, that bacteria cannot long endure the direct ultra-violet rays of three ten-thousandths of a millimeter in length. American tests have shown that it required only one-twentieth of a second to kill bacteria with such rays, but they must not be intercepted by suspended organic matter in the water. It is, therefore, necessary that the water be rid of turbidity before applying the ultra-violet ray process to its sterilization, for Dr. Von Reckling-Hausen declared that it is the light and not chemical reaction that produces the germicidal results. Ultra-violet ray tests made at Luneville, France, on water containing 60,000 germs per cubic centimeter reduced the number to 10 germs per cubic centimeter and destroyed all *B. coli*. The death rate of 70 to 160 of typhoid fever also became negligible. Since devastations of the Great World War began, the water supply of northern France has been contaminated at the rate of 4,600 putrescent bacteria and 1,000 *B. coli* per cubic centimeter and they may go on for years in an increasing ratio, in consequence of the countless burials and pollution of the underground waters of the war zone. The Quartz-Mercury lamp is sometimes used to produce ultra-violet rays for the sterilization of water. That process eliminated nearly all the bacteria from the raw Durance river water at Marseilles.

7. By Sterilization.— Purification is also generally effected by sterilization, which is used in conjunction with several of the processes already mentioned. By reason of the various chemicals used and their germicidal action on micro-organisms, irrespective of the other agencies employed, too much attention cannot be given to the process of sterilization.

In recent years some public water supplies have been purified by sterilization, where sewage bacteria now known as *anærobic spore-forming bacilli*, including *B. ærogenes capsulatus*, *B. enteritidis*, or *B. sporogenes* and *B. streptococci* were present. Active agents were necessary to destroy them. The basins or reservoirs where the process of sterilization is in operation must be cleansed two or more times a day.

In 1892, the English employed calcium hypochlorite to disinfect sewage. In the following year the American Public Health Association recommended its use as a disinfectant. It was known in 1892 that hypochlorites were efficient water sterilizers. In 1897 they were first used at Maidstone, England, to purify its water supply, after a typhoid epidemic. In 1904 they were applied to disinfect the water pipes in London. Thereafter they came into quite general use in this and other countries. Hypochlorite of lime and hypochlorite of soda are the principal chemicals used. Where hypochlorite of lime is used its solutions are thoroughly mixed with the raw water in the proportion of 5 to 10 pounds of the powder to 1,000,000 gallons of water, which is destructive of such pathogenic germs as typhoid, cholera and other bacilli. The objection to this chemical is that a sludge is formed, which interrupts the flow through the orifices and is also injurious to aquatic life, when deposited in fresh waters. Hypochlorite of soda, electrolytically produced, is somewhat more destructive of pathogenic bacteria than hypochlorite of lime. It is not difficult to produce and does not form sludge. The hypochlorites, however, are not a substitute for filtration, but rather additional agencies, that may be used to ensure complete destruction of pathogenic germs. Some spore-forming bacteria in water are not pathogenic and not all of these are destroyed, because they are hardy and not affected by any of these chemicals, when in such small proportions as not to affect the water deleteriously, but made sufficiently active to destroy pathogenic germs, which are less hardy. Many cities in this and in other countries use the hypochlorite processes in connection with sedimentation and filtration.

Francis F. Langley reported (*American Journal Public Health*, 4 Dec. 1914) that two billion gallons of water per day were being treated with bleaching powder, or chlorine gas As already stated, liquid chlorine being the liquification of chlorine gas, produced by the electrolysis of sodium chloride in the manufacture of canstic soda, is also used to sterilize water supplies. There are several devices for applying the gas, which is eliminated from the liquid by heat, to the tanks of water to be treated. The gaseous vapor is diffused through the water and destroys the pathogenic germs. Some of the chlorinated water so sterilized in the tower of Wilmington contained only from 6 to 50 bacteria per cubic centimeter. Liquid chlorine is one of the sterilizing agencies used in Chicago Stock Yards, at Philadelphia, Pa., Saint Louis, Mo., Trenton and Newark, N. J., Cincinnati, Ohio, Niagara Falls and Ossining, N. Y., Hartford and Stamford, Conn., Saint Catherines and other places in Canada and at Honolulu, Hawaii, and elsewhere.

The ferrochlorine process of sterilization has been tested in Paris and found to be an efficient bactericide, though on account of its cost it is not in general use. Another sterilizing chemical was proposed in the form of copper sulphates, but that has not been generally adopted. It was proposed as a sterilizing process to dispose of microscopic organisms. The research work of the Bureau of Plant Industry of the United States Department of Agriculture, D. D. Jackson in his work on 'Odors and Tastes of Surface Waters,' and especially George C. Whipple, department engineer under the Burr-Hering-Freeman Commission, on the Additional Water Supply of New York City, and others have called attention to algæ, and *spore-forming diatomaceæ* (*diatoms*), or *bacillariæ*, now classified as vegetative organisms, varying in diameter from one thousandth of a millimeter to one millimeter. Several species of these microscopic organisms are found in fresh waters. Several species

Anopheles have been localized in the waters of Alabama, South Carolina and North Carolina by Dr. H. R. Carter and others of the United States Public Health Service. *Anopheles* are the cause of malaria. Mosquito-eating fish are being introduced to rid such waters of the *Anopheles* larvae.

Dr. Zacharias has identified the animalcula known as *flagellata*, which multiply rapidly and discolor surface waters. *Rhizopods*, including *amoebæ*, *difflugia* and other genera; and *infusoria* which are the highest type of *Protozoa*, are also microscopic. Some are free-swimming and others attached animalcula. They exist in countless colonies and some of them are internal parasites. These infest reservoirs and other potable waters. The larvæ of *chironomus* are found in upper layers of sand of waterworks in great colonies. Green and blue *algæ* known in Germany as "water blossoms," *zooglœa*, *beggiatoa* and innumerable other micro-organisms infest waterworks, form slimy organic patches and undergo putrefactive changes. These decompose and produce odors and give water an unpleasant taste. George T. Moore and Dr. Karl F. Kellerman of the United States Department of Agriculture recommended the use of copper sulphate, but that does not always destroy all the typhoid bacilli and is a dangerous chemical to use, except in the smallest quantities, and when so used it is less efficient than the chlorides. Therefore it has not come into general use.

Nearly all the processes of sterilization are of recent discovery and those in general use are ridding potable waters of most of their pathogenic bacteria. Prior to their discovery half a century ago, they were the causes of epidemics that wasted away communities and historians referred to them as pestilences and plagues. It may be assumed that polluted water has destroyed as many human lives as the wars of all the ages.

Progressive nations are fast coming to realize that impure water is one of the greatest known menaces to health and to life itself. In this modern era the researches of scientists and experiments by health authorities have demonstrated that most pathogenic bacteria and nearly all living organisms in surface and other waters may be eliminated therefrom and all such waters may be made safe for potable and all other uses.

Communities are no longer limited to lakes, mountain streams, springs and other ground sources for their water supply, but may draw raw water from rivers, streams, lakes and ponds provided such waters be treated by some of the processes heretofore mentioned, that will render such waters pure and wholesome, as is being done by scores of cities in this and other countries. The water supply of a community is now largely a matter of purification, and while turbid or bacteria-laden waters are not desirable on account of the expense involved in carrying on the processes of purification, still if other adequate sources be not available, river and other surface waters may be made safe for potable purposes. Thus it is possible for communities to obtain their supply from nearby surface waters.

The Hudson, the Ohio, the Mississippi, the Niagara, the Saint Lawrence, the Thames, the Seine, the Rhine, the Rhone, the Elbe, the Danube, the Volga, the Nile, the Ganges, the Irrawaddy, the Yangtse-Kiang and scores of other rivers, as well as the Great Lakes in North America, the British, Swiss, Italian, African and innumerable other lakes are the sources of the water supply for millions of population. When such waters are scientifically treated by some of the processes hereinbefore described, they are safe and palatable. The importance of preserving all such surface waters from artificial contamination has led to the enactment of many laws to prevent such contamination. In America and Europe water supply authorities are usually empowered to acquire catchment areas and in some instances large parts of watersheds to prevent artificial contamination as well as to procure additional sources as has been done by New York City in acquiring the Catskill watershed and certain British cities in acquiring large additional areas to ensure wholesome water supplies. Rather slowly the public conscience is being enlightened and awakening to the dangers of the contamination of water supply sources, in permitting the inflow of sewage, effluents from industrial plants, gas refuse, chemical works and other artificial wastes, all of which pollute and render waters noxious in their natural state. Most of these, however, are susceptible of such treatment as to ensure their wholesomeness for potable purposes.

The introduction and general adoption of scientific processes for the purification of water for municipal and domestic purposes hereinbefore described and others have necessitated the discontinuance of the use, or the demolition of many old and the installation of many new waterworks in this and other countries. The needs of each community and the physical conditions of the territory of each whence its supply must come, as well as the water sources themselves, become matters of public investigation and of scientific study. This was demonstrated in the undertaking on the part of the city of New York to obtain its additional water supply, commencing in 1896 and continuing for 20 years or longer. Such progress has been made in the scientific treatment of water for municipal purposes, that, in addition to a score or more of processes for its purification in most any state, its acidity may be neutralized, as at Mossley, England, it may be softened by any one of several processes, or it may be hardened and it may be deferrized as in Germany to get rid of the microscopic crenothrix and other bacteria absorbing iron into their tissues and closing water mains.

In all these matters conditions differ and it is necessary to specialize in the treatment of each municipal water supply. No two are identical, unless they form parts of the same system, as now does the supply for several boroughs of New York City, when the same general principles may apply, as to the collection, purification and distribution of water for such boroughs. But in most cases, each supply must be studied independently of all others and provided for, with special reference to its peculiar characteristics, which are as variable as earth's watersheds.

Removal of the Salts of Calcium, Magnesium, Iron and Manganese.— In some well

and other ground waters such minerals as salts of calcium, magnesium, iron and manganese are found in solution. An artificial zeolite, known as "Permutit," was produced by Dr. Richard Gans and is used to rid water of its calcium and magnesium. Caustic soda, the silica of sodium, barium carbonate and other chemicals are also used for that purpose. The Reisert zeolite and other water softeners are in use in this and other countries. C. P. Hoover and R. D. Scott in Ohio, R. N. Kimmard, Dr. Edward Bartow, Samuel A. Greeley, Francis G. Wickware and others have written on the subject of water softening by the "Permutit" or other processes. There is a large plant for softening at Winnepeg, Canada, and smaller ones at Oberlin, Ohio, and elsewhere in the United States.

The extraction of iron and manganese has also been studied by Dr. Gans, M. S. Applebaum, Dr. H. Luhrig, Frank E. Hale, R. S. Weston, F. C. Amsbary and others. Plants for deferrization of water have been installed at Middleboro, Mass., at Rotterdam, at Dresden, Breslau and Hamburg in Germany and elsewhere. The process is described in the reports of those specialists and is generally effective in eliminating those minerals from such waters, though there may remain in water pipes the *crenothrix, cladothrix, clonothrix, chlamydothrix* and *gallionella* organisms that flourish in such solutions. Karl Kraepelin found 60 species of animalcula, infesting the water pipes of Hamburg and known as "pipe moss" comprising *sponges, spongilla fluviatilis* and *lacustris, molusca, snails,* "water lice," *asellus aquaticus,* "water crabs" (*Gammarus pulex*) and other species. Rotterdam, Boston and Brooklyn have encountered troublesome growths in their water pipes.

Minor Processes.— Some of the minor processes of purification involve the use of the small mechanical filters, consisting of small basins of layers of sand, over which gelatinous films of aluminum hydrate are found. Water passes through these rapidly and the bacteria are caught in gelatinous material and removed. Such filters are used to clarify muddy waters during freshets and in limited areas, where sufficient land cannot be economically obtained for sedimentary and the slow sand filter beds. There are several hundred in use in America. Where properly constructed and operated, satisfactory results are obtained, but they must be cleansed twice or more times a day and the chemicals used in sterilization are expensive. Several such filters, including the Candy and Reisert types, are in successful operation.

The Lawrence filter first installed in the United States was the forerunner of other mechanical filters, that have proved quite efficient in purifying municipal water supplies.

Porcelain Filters.— Prof. Louis Pasteur and others have suggested porcelain and baked infusorial earth, as additional safeguards, but the necessity of their frequent sterilization and the cost of such filters render them impracticable for general water-supply purposes. Bacteriologists now contend that microbes are propagated in and are not eliminated by porcelain filters. There are other minor processes for the purification of water, such as granular bed filters, charcoal filters, porous wall filters Berkefeld system, Maignen method and the boiling of water. None of these processes are efficient in disposing of all the pathogenic bacteria. Some of these, such as *B. anthracis* and its spores, *B. typhosus* and others, are very persistent and live a long time in water. H. D. Fisher, Prof. John Tyndall and French and German bacteriologists have insisted that the boiling of water at 212° F. does not destroy the spore-bearing bacteria, though it may and does destroy many other species.

Collection, Impounding and Distribution of Water Supplies.

In the collection, impounding and distribution of water for water-supply purposes, a few systems will suffice to illustrate how many operate. As already stated, many communities obtain their supply from ground waters by means of wells and springs.

Batavia in the East Indies, notorious for its unhealthfulness, supplies its 240,000 inhabitants from ordinary wells. Many ground waters are polluted by surface waters.

Amsterdam derives its supply from open canals containing the waters collected from sand dunes and also from the river Vecht. Such waters are filtered. Antwerp derives its supply from polluted river water, which is treated and also filtered.

Rotterdam obtains its supply from Maas (Rhine), which is then filtered.

Magdeburg and Altona obtain their supplies from the Elbe, which are treated and filtered. Breslau obtains its supply from the Oder, Budapest from the Danube, Petrograd from the Neva, and Warsaw from the Weichsel River. All such raw waters are filtered and some, or all of them, treated with germicidal disinfectants.

Constantinople obtains its supply from streams, springs and forest catchment areas, where the waters are collected in impounding reservoirs and conducted in aqueducts to the city.

Damascus obtains its supply from the Abana River through conduits, which also convey water for power purposes. See *Syria* in article on Rainfall.

Jerusalem obtains its water from springs, cisterns and pools, fed by conduits bringing water from Ain Saleh and other distant springs. Water from the Virgin Fountain flows through a tunnel to the Pool of Siloam.

In Phœnicia near Tyre were waterworks, consisting of towers, into which the artesian well waters flowed upward to a height of 20 feet or more above ground. Those waters were then conducted into reservoirs for the supply of that ancient port.

Berlin, Germany, obtains most of its water from deep boreholes near the shores of Lake Tegel, an expansion of the Havel River, and from Lake Muggel, one of the expansions of the Spree. These contain some iron in solution, as do most ground waters of Germany. It also obtains part of its supply from wells, since it has succeeded in eliminating iron from its ground waters.

The Spree was said to contain 2,500,000 more bacteria per cubic centimeter below Berlin than it contained above Berlin.

In 1878 *crenothrix* was found in the raw

water of the Spree and in wells at Charlottenburg. Dr. Richard Gans' new method and Herr Pielke's process were used to eliminate the iron and the bacteria, such as *crenothrix* and other micro-organisms dependent thereon. There are 60 or more sand filters with an aggregate area of 35 or more acres and other processes used to purify daily 66,000,000 gallons of water which is pumped into the city. The bacterial reduction in 1900 was from 896 to 27 per cubic centimeter in Muggelsee Works and from 345 to 22 per cubic centimeter in the Tegeler Works. There the death rate from typhoid fever and other diseases traceable to pathogenic bacteria is low. A new testing station of its water supply and sewage disposal is maintained in Berlin. In 1911 Berlin daily consumed 22 gallons for each of its 2,200,000 inhabitants. One of the most extensive plants in Germany for removing iron from ground water is that at Erlenstegen for removing the iron from the ground water supply of Nuremberg. Munich obtains its water supply chiefly from spring and infiltration galleries constructed in the layers of sand and gravel in the western slopes of the Alps. Those galleries of concrete in some parts intercept the flow of ground waters. The water so collected is conducted to the city, which in 1911 consumed daily 57 gallons for each of its 571,000 inhabitants.

Hamburg obtained its water from the river Elbe and prior to the epidemic of Asiatic cholera in 1892, that water was unfiltered. In 1893 a municipal filtering plant was installed. Later a deferrization plant was also installed there. In 1913 Hamburg daily consumed 37 gallons for each of its 977,000 inhabitants. Double filtration is employed in Altona, Bremen and Schiedam.

Vienna obtains its supply of pure water through masonry-arched aqueducts, whose interior measurements are 0.84 by 0.93 meters from springs 913 feet and 1,196 feet, respectively, above sea-level and about 400 feet to 600 feet above distributing reservoirs in the city and from ground waters in the Schneeberg region 59 miles distant in the Alps, and from other springs and the Salza River, 114 miles distant. These are gravity systems, but in the city some pumping is necessary to fill the highest service reservoirs about 550 feet above sea-level. Since its introduction and the use of sterilizing agencies typhoid has nearly disappeared. Such Alpine sources, however, are quite devoid of pathogenic bacteria. In 1914 Vienna consumed 25 gallons per day for each of its 2,066,000 inhabitants.

Rome for centuries has obtained its water supply from the Tiber and springs along its left bank and later from such Apennine sources as the Appia, the Anio Vetus, Aqua Tepula and Lacus Alsietinus and from such springs as fed the Aqua Virgo, Aqua Marcia and Aqua Claudia and from the Rivus Herculaneus. The Aquia Trajana drew its waters from springs west of Lacus Sabatinus, whose polluted waters contaminated those of the aqueduct. Aqua Alexandrina drew its waters from springs that now supply Aqua Felice. The Aqua Marcia drew its waters from numberless springs, discovered by Marcius in 145 B.C. Most of the longer aqueducts were partially subterranean and some have entirely disappeared.

From 'The Aqueducts of Ancient Rome,' by John Henry Parker, the following important facts are derived as to the water supply of Rome, one of the problems for engineers to solve.

In the time of Nerva and Trajan from 94 to 107 A.D. Sextus Julius Frontinus was water commissioner of Rome and has left a report of some of its remarkable works. At that time he says nine aqueducts entered the city, namely, (I) Aqua Appia; (II) Aqua Vetus; (III) Aqua Marcia; (IV) Aqua Tepula; (V) Aqua Julia; (VI) Aqua Virgo; (VII) Aqua Alsietina; (VIII) Aqua Claudia, and (IX) Aqua Novus. Seven were constructed later, namely, (X) Aqua Sabbatina, A.D. 110; (XI) Aqua Trajana, A.D. 120; (XII) Aqua Aurelia, A.D. 185; (XIII) Aqua Severiana, A.D. 190; (XIV) Aqua Antoniniana, A.D. 215; (XV) Aqua Alexandriana, A.D. 225; (XVI) Aqua Algentiana, A.D. 300. In the Middle Ages two more were constructed, namely, (XVII) Aqua Carbra and Marrana, A.D. 1124, and (XVIII) Aqua Felice. Some of these are also known by other names, namely (VII) Aqua Claudia as Cerulea; (IX) Aqua Novus as Attica; (XVII) Aqua Crabra and Marrana as Herculea; (I) Aqua Appia as Augustea; (IX) Aqua Claudia, or (X) Sabbatina as Ciminia and Cloaca Maxima as Damnata, which forms the lake of Curtius.

The Roman engineers so constructed conduits that they had frequent openings and angular turns with possible intercepting bars or baffles to check the flow of matter in suspension and thereby rid the water of some of its impurities, which, except those brought by the Paola (or ancient Sabatina) aqueduct, were few on account of its Apennine and other sources. There were many *piscinæ* or *castella aquæ* or reservoirs, where sedimentation and some filtration took place and visible foreign matter was removed. The Romans had many thermæ and fully understood the importance of pure water. The Piscina Mirabilis at Baiæ is well preserved, which place the author visited in 1905.

William P. Mason in his 'Water Supply' quotes a passage from Pliny's 'Natural History' which has been translated as follows: "Among the blessings conferred on the city by the bounty of the gods is the water of the Marcia, the cleanest of all the waters in the world, distinguished for coolness and salubrity." The Romans had such baths as those of Caracalla, Diocletian and Titus where they repaired for hot and cold baths, for hygienic exercises and where they engaged in the discussion of political, philosophical and other topics. They gave much consideration to their water supply. They built aqueducts to bring water from distant mountain sources, that have been the admiration of later ages. Modern Rome has a daily supply of 65,000,000 gallons obtained largely through the Vergine, Felice, Paolo and Pia (or ancient Marcia) aqueducts and from springs. The Vergine aqueduct is 11.8 miles long and daily conveys its 14.08 million gallons of spring water 79 feet above sea-level, discharging it in Rome 66 feet above sea level. The Felice aqueduct daily conveys its 4.4 million gallons of spring water, the intake being 217 feet above sea-level, 22 miles from Rome, the aqueduct running over arches 6.25 miles and

the remainder of the distance underground and delivers its waters 202 feet above sea-level. The Paolo aqueduct daily draws 17.6 million gallons from Lake Bracciano, 538 feet above sea-level and from springs in Manziano, Bracciano and Ficarello 32.33 miles from Rome and delivers its supply partly in Rome at an elevation of 246 feet above sea-level to supply the fountains of the Piazza Saint Pietro and partly to supply the town of Leonina. The Pia or Marcia aqueduct, 33 miles long, is fed by a number of springs near Subiaco 1,000 feet above sea-level. It follows that valley of the Anio to Tivoli and conveys 27 or more million gallons daily into the ancient Varo reservoir, having a capacity of 214,000 gallons and being 578 feet above sea-level, and thence to Rome. The water is conducted through three cast-iron pipes 24 inches in diameter into different parts of Rome. It also derives some of its waters from springs nearer Rome than the above sources. Its numerous fountains are supplied with waters conducted through some of the old aqueducts, whose names have undergone some change, as above stated, in consequence of the discovery of additional sources by various emperors and the connection thereof with the old aqueducts. The poorer qualities of water were used for fountains, public baths and other non-potable municipal purposes.

In 1900 some of the waters in their natural state carried too large a number of bacteria for safety, but since that time it is possible that some of the recent processes of purification may have been utilized. The ozone process is adequate to rid such waters of their pathogenic germs. In 1911 modern Rome daily consumed 120 gallons of water for each of its 542,000 inhabitants. During the Roman era it consumed approximately 32,000,000 gallons daily. The remains of Roman aqueducts still exist in Asia Minor, Algeria, France, Spain and elsewhere, showing that the Romans took great pains and went to great expense to provide their cities with the best natural waters obtainable. Some of the aqueducts were of superb construction, as were the Pont-du-Gard, the aqueduct at Segovia and the Aqua Claudia, extending along the Roman Campagna.

Naples obtains its supply in part from ground waters collected in filtration galleries 2,000 feet or more in length, constructed in a stratum of gravel 30 feet below the surface, wherein are daily collected 38,000,000 gallons. Five parallel tunnels have been formed in the old quarries of Capodimonte for impounding such waters. The Apulian aqueduct in the southeastern part of Italy is of masonry construction for 151 miles. Its main trunk line and lateral branches altogether are 1,690 miles in length. Its waters supply 152 service reservoirs and nearly 2,000,000 of people. Italy has both the Alps and the Apennines to intercept the vapor-laden clouds, whose waters supply its many streams and its dense population.

Paris has two general systems for supplying water under different pressures, namely, (1) a high-pressure system for its domestic or potable supply, (2) a low-pressure system for industrial, street-cleaning and general municipal, other than potable purposes.

1. Paris obtains its high-pressure supply for domestic purposes from four sources, namely, (a) from the springs that are tributaries of the Vanne River 108 miles distant, conducted through the Vanne aqueduct into the two-story reservoir at Montrouge 262 feet above sea-level; (b) from springs that are tributaries to the Loing and Lunain rivers, whose waters are conducted through the Loing and Lunain aqueduct into the Monsouris reservoir (that supply and the Syphon aqueduct are described and illustrated in 'La Derivation du Sources du Loing et du Lunnain' par Bechmann et Babinet, published at Paris 1905); (c) from the Dhuis springs 82 miles distant, flowing from the east through the Dhuis aqueduct into reservoirs at Menilmontant having an elevation of 354 feet above the sea, and (d) an additional supply for domestic purposes from the springs of the Avre, 63 miles west of the city, flowing through an aqueduct into Saint Cloud reservoir. During the World War the Dhuis supply was cut off and the demands on the other sources were greatly increased.

2. Paris obtains its low-pressure supply for industrial and general municipal, other than potable, purposes from the Seine pumped at Ivry and at other places on that river and from the Marne at Saint Maur and from the Ourcq Canal and from artesian wells, and water is also obtained through the Arcueil aqueduct from Rungis.

The works at Saint Maur include sedimentation basins, sand filters, ozone sterilizers and a bacteriological laboratory. In pre-war 1914 conditions, the raw Marne water carried 12,000 *B. coli* per cubic centimeter. After passing the sand filters these were reduced to 300, which disappeared as the water passed through the ozone sterilizers. An additional supply for domestic purposes was found necessary and river water was thoroughly treated, purified and used. The entire supply for domestic and potable purposes before the World War was about 40 gallons per day for each resident of the city. The supply for other municipal purposes is three times per capita the amount used for domestic and potable purposes. Since the World War, the Marne and other rivers in northeastern France, in which are countless human remains, have carried a great increase of pathogenic and other bacteria. The water supply of the entire war zone has been polluted.

The ozone treatment was so successful at Saint Maur that it was adopted by the municipality of Paris to purify the water of the Seine, taken to supplement its general municipal water supply. Miquel in 1896 found 300 bacteria per cubic centimeter in the Seine above Paris and Clichy found 200,000 bacteria per cubic centimeter in the Seine below Paris.

The Belleville reservoir has two stories. The upper receives water from the Dhuis aqueduct and the lower from the river. The Montrouge receives water from the Vanne aqueduct into its upper stories and water from the river into its lower story. The Montmartre reservoir receives spring water into its three upper stories and river water into its lower story.

The water supply of the city of London is obtained from the yield of the watersheds of the Thames, the Lea and the New River, comprising an area of 620 square miles and from

springs and many wells in those watersheds and in the chalk deposits of Kent. Formerly eight or more companies pumped the water from the Thames, the Lea and the New rivers and from springs and wells into 65 or more reservoirs. Some of the principal ones were included in the works of the New River Company, the East London Waterworks Company, The Southwark and Vauxhall Water Company, the Company of the West Middlesex Works, the Company of Proprietors of Lambeth Waterworks, The Governor and Company of Chelsea Waterworks, The Grand Junction Waterworks Company, The Company and Proprietors of the Kent Waterworks and The Staines Reservoirs Joint Committee, supplying Kempton Park reservoir. In the literature on the subject these legal titles are omitted and the popular names of the particular companies are used.

From the Thames above its tidal flow and above Teddington lock, 185½ million gallons were available, from the Lea all its flow except 5,400,000 gallons left for navigation and from the New River 22½ million gallons were pumped. Upward of 33,000,000 gallons were obtained from springs and wells. In 1900 London consumed 226,000,000 gallons of water daily, which was distributed through 3,500 miles of pipes. The Thames, the Lea and the New rivers 20 years ago were subject to pollution from the inflowing surface waters, and their filtered waters as well as waters obtained from wells contained from 15 to 100 bacteria per cubic centimeter. In 1902 an act was passed creating the Metropolis Water Board. It was authorized to acquire the properties of the eight or more water companies above named and to enforce rigid regulations for the protection from pollution of the sources of London's water supply. Royal commissions investigated and reported on the purity of the supply, and out of the 294 experiments made by Dr. A. C. Houston in 1907–08, not a *bacillus typhosus* was isolated, though millions of bacteria were discovered, the Lea being most heavily laden with them.

The Metropolitan Water Board was created by the act of 1907. That board took over the properties and facilities of the Metropolis Water Board. The New Works Act of 1911, authorized the Metropolitan Water Board to construct large storage reservoirs at Staines, Laleham and Shepperton. New service reservoirs were constructed on Horseendon Hill, Greenford and on Barn Hill.

In January 1913 the Metropolitan Water Board, through the various intakes, drew daily from the Thames 132,859,184 gallons and from the Lea 55,300,700 gallons and from springs and wells 36,712,390 gallons and from ponds 203,600 gallons. The aggregate of that supply was 225,075,874 gallons, which was at the rate of 33.44 gallons per person. New reservoirs are being constructed to provide additional waters and the daily consumption in 1918 was reported at 39 gallons per capita for a total population of 6,783,897.

Parliament has passed several acts for the conservancy of the waters of the Thames, Lea, New and other rivers and has empowered boards and commissions to take such action as may be necessary to protect the waters of said rivers from pollution by regulating the uses of their watersheds and otherwise by enforcing sanitary ordinances on the part of cities, towns and villages.

Most thorough and exhaustive investigations have been made in both London and Paris to ascertain the quality and the bacteria in the raw waters, which are the sources of supply for those cities and every precaution is taken to rid all such potable waters of their pathogenic species.

The official reports of Dr. A. C. Houston, director of the Metropolitan Water Board, over a series of years and of his skilled staff of experts at London are exhaustive. They show all phases of the water supply of London, including its sources, amount, quality, bacteriological and chemical tests, the processes for its purification, the results obtained, its distribution and all other conditions incidental thereto. In his official report for 1913 Dr. Houston said that "about eighty percent of the London Water Supply is derived from rivers polluted directly or indirectly with sewage, . . . that the three factors of sedimentation, devitalization and equalization are indeed of supreme importance in connection with the storage of impure water antecedent to its filtration. . . . The practice of occasionally 'dragging' or 'raking' the surface of the filter beds to increase the yield of water or to prolong their working periods should be discontinued altogether, or only resorted to under quite exceptional circumstances. . . . Over eight years' work on the London water question has convinced me that to a progressively increasing extent the Water Board are securing the reasonable if not absolute 'safety' of the Metropolitan Water Supply. This opinion will carry the more weight since I have been, and still remain, a somewhat merciless critic of any imperfections in processes of water purification. . . . As a counsel of perfection, I still feel bound to advocate the choice of an initially pure source of water supply; but my own results and experiments do seem to indicate clearly that the evil effects even of an impure source can be largely, if not entirely, annulled by adequate storage and efficient filtration. . . . In conclusion, my opinion is that the '*quality* policy' of the Metropolitan Water Board should be directed towards securing an 'epidemiologically sterile' water (i.e., a water containing none of the microbes associated with waterborne epidemic disease) *antecedent* to filtration by means of storage (sedimentation, devitalization and equalization) aided, if need be, by the occasional employment of supplementary processes of water purification."

For the years 1906–13 the average number of microbes per cubic centimeter as reported by Dr. Houston in raw Thames water were 4,894, in the raw Lea water were 13,293 and in the raw New River water were 2,081.

He also reported that by the processes of subsidence and filtrations the number in raw Thames water was reduced from 5,250 to 16.1 per cubic centimeter, in raw Lea water from 9,263 to 30.9 per cubic centimeter and in the raw New River water from 2,172 to 14.1 per cubic centimeter. In all these cases the reduction was upward of 99 per cent. The filtered waters from Kent had but 7 microbes per cubic centimeter and there were in the Chelsea filtered supply only 7.3 microbes per cubic centimeter.

Dr. Houston in his report for 1913 also stated that "The striking fact has been shown in my last reports that London is not really drinking merely filtered raw river water but raw river water, which by storage processes has been purified bacteriologically antecedent to filtration to a reasonable extent. . . . When it is remembered 90.5 per cent of the samples of raw Thames contain typical *B. coli* in each cubic centimetre and that 84.8 per cent of the samples of raw Lea water also contains typical *B. coli* in each cubic centimetre, the transformation which the river water has undergone previous to filtration becomes strikingly apparent." Dr. Houston strongly advises storage preliminary to filtration and storage he says means sedimentation, devitalisation and equalization. Nearly the entire supply for London is stored antecedent to filtration. Dr. Houston also stated that "99.9 per cent of the typhoid bacilli could not be recovered after one week."

Down to 1913 storage and sand filters had efficiently purified the waters used for potable purposes in London. Dr. Houston, however, in his report for the year recommended supplementary processes of purification. Since 1917 the entire water supply of London has been treated with chlorine. Before filtration, it receives a dose of calcium hypochlorite. Slow-sand filters are now used at the various works.

The twelfth annual report of Director Houston for the year 1917–18, contains an exhaustive report of chlorination, super-chlorination and de-chlorination experiments with 224 micro-photographs.

The thirteenth annual report of the director for the year ending 31 March 1919, discusses the scientific results of the chlorination of the Thames and New River raw river waters and chlorination in relation to filtration and the condition of the raw and filtered waters. On 31 March 1919, the equipment of the London water supply under the Metropolitan Water Board comprised 48 storage reservoirs with a total capacity of 1,981,500,000 gallons and 86 service reservoirs for filtered water with a capacity of 310,900,000 gallons and its 172 filter beds had a total area of 170.7 acres.

Liverpool obtains its supply from wells, from eight impounding reservoirs in the watershed, Ravington having a capacity of 4.1 billion gallons and from the impounding reservoir, the largest in Europe, 825 feet above sea-level, formed by a dam 1,172 feet long and 84 feet high across the valley of the Vyrnwy River, formerly a glacial lake in north Wales, having a capacity of 12 1/7 billion gallons. The impounded waters from the Ravington reservoirs are delivered through a 44-inch cast-iron pipe 24½ miles long to Liverpool and from Vyrnwy reservoir through a 39-inch cast-iron pipe 63 miles long and a tunnel 4 miles long to Prescott reservoir at Liverpool. The water is filtered through sand filters and otherwise treated. Upward of 38,000,000 gallons are consumed daily in Liverpool, which is at the rate of 40 gallons per capita per day. An additional reservoir has been constructed near Malpas and a high-level tank has been built at Woolton Hill.

Manchester obtains its water supply from the elevated Longdendale watershed with seven or more impounding reservoirs along the Etherow River and from Lake Thirlmere 2¼ miles long and 533 above sea-level in the north-western part of England. The outlet of the lake is closed by a masonry structure 857 feet long and 104½ feet high from the lowest part of the gorge outlet. That enlarges the lake to three and one-fourth miles in length and gives it a capacity of eight and one-seventh billion gallons. The aqueduct leading to the city is 95 miles long and carries 50,000,000 gallons per day. The storage reservoirs of Manchester have a capacity of upward of 41,000,000 gallons. Its daily consumption is 40 gallons per capita and aggregates 50,000,000 gallons. A third conduit has recently been constructed from the lake to the city.

Birmingham, England, formerly obtained its water supply from five local streams and eight wells. From these the water was pumped into six service reservoirs at different elevations and into a stand-pipe. All such waters were filtered. In 1900 there were 12 sand filter beds with a total area of eight and one-fourth acres. In 1892 Parliament authorized Birmingham to draw an additional supply from Elan and Claerwen rivers in Wales. It constructed six long reservoirs by building masonry dams across the narrow valleys of those rivers, one of which dams was 600 feet long and some were more than 100 feet in height above the bed of the gorges so closed. They had a combined capacity of 18,000,000,000 gallons. There were also constructed 30 filter beds for the filtration of all such waters. This improvement contemplated a supply of 75,000,000 gallons a day for service in addition to 27,000,000 gallons to compensate for losses to riparian operators along the Wye.

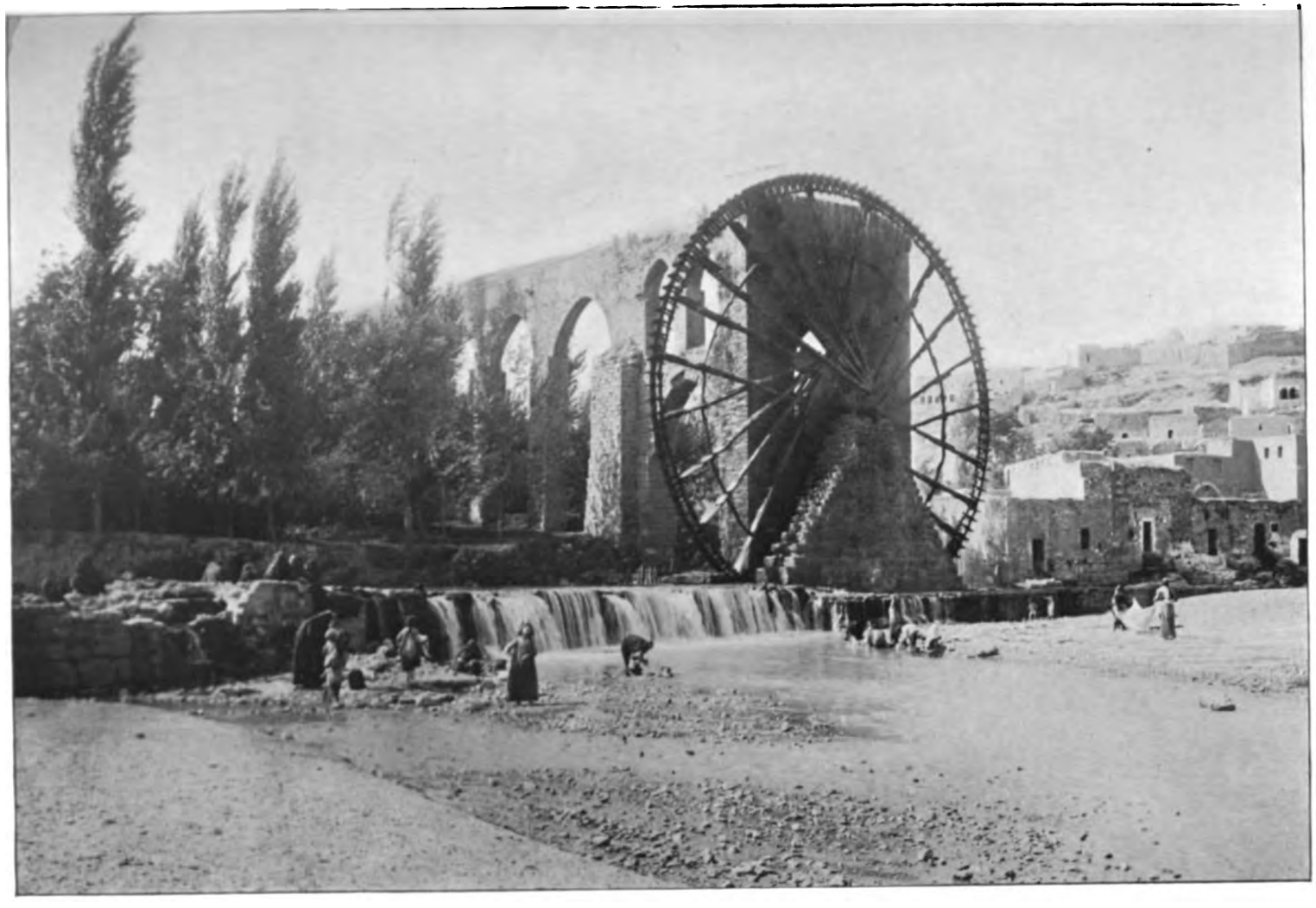
The water flows by gravity through the Elan aqueduct 73.3 miles to Birmingham. From the elevated sources to the high service reservoirs in Birmingham there is a fall of 170 feet.

In 1913 there were consumed 27,471,991 gallons daily, which was an average of 32.24 gallons for each resident.

Glasgow obtains its water supply from Brock Burn six miles from the city through its Gorbals works into four impounding reservoirs, having a combined capacity of 1,000,000,000 gallons or more and also from Loch Katrine 364 feet above sea-level, having a storage capacity of five and two-thirds billion gallons. The water was conducted by gravity through aqueducts and tunnels 27 miles to Mugdock and Craigmaddie reservoirs, having a combined capacity of one and one-fifth billion gallons. Reservoirs have been constructed in the valley of the Teith to compensate for waters drawn by the city. In 1895 it was decided to connect by the tunnel Loch Arklet 455 feet above sea-level with Loch Katrine and raise the outlet of the latter five feet and thereby secure a storage capacity of 2.05 billion gallons in the two lochs. An additional reservoir with a capacity of 694,000,000 gallons has been constructed. In 1913–14 Glasgow daily consumed 75 gallons per capita or an aggregate of 85,000,000 gallons.

Edinburgh obtains its water supply from the Esk, the water of Leith and from the streams fed by the Pentlands, the Moorfoot Hills and from Talla Water reservoir. Talla Water is an affluent of the River Tweed.

In 1913 the daily consumption of water in



The great waterwheel at Hamá, Syria, used for pumping the water out of the Orontes River

Edinburgh and Leith was 56 gallons per capita.

The Derwent Valley Water Supply under an Act of Parliament, is distributed to Derby, Leicester, Nottingham and Sheffield, the expense of which is borne by said several corporations in proportion to their several allotments or percentages of water consumed, all drawing from the same source, made available by their joint effort. That plan might be carried out in other countries where a common supply may be available for several municipalities.

In 1907 the Earl of Cromer reported that the Assouan reservoir would supply one-fourth of all the water needed in Egypt. That water flowed from the upper Nile 1,800 miles to reach Egypt. The evaporation in those torrid and tropical regions was 103,000,000 cubic meters out of 2,300,000,000 cubic meters of supply and the loss by absorption and filling the Nile trough was 260,000,000 cubic meters, and the consumption in middle Egypt was 850,000,000 cubic meters, which left only 1,087,000,000 cubic meters for use in Lower Egypt at Cairo. That statement shows the great losses of river or canal waters due to evaporation and percolation or absorption. Under all conditions they are factors to be considered in determining the amount of water supply for a community. Long before the Assouan reservoir was constructed, Jacob had dug a well near the site of Cairo and still earlier the Fayum depression was embanked and Lake Moeris was formed, around whose shores were settlements from the Neolithic age down through many centuries.

In 1914 Cairo used for all purposes an amount equivalent to 25 gallons for each of its 700,000 residents. Its water is clarified by passing it through rapid sand filters. Alexandria has a similar plant of 12,000,000 gallons daily capacity, where sulphate of aluminum is used as a coagulant.

The importance of wholesale water supplies to communities cannot be too emphatically stated, when we recall the ravages of diseases due to the contaminated water supplies in India. Prior to the British sovereignty of that Peninsula nearly all well, river and surface waters were unfit for potable purposes. Conditions there were appalling. The waters of the Indus, the sacred Ganges, the Brahmaputra and of all other rivers were laden with putrescent matter and some with decomposing human remains. Even the wells were contaminated and the thousands of reservoirs and tanks were used as bathing pools by thousands of dust begrimed and filthy pilgrims in their annual tours of parts of India. They were ignorant of the laws of health and oblivious of all hygienic and sanitary regulations. That was the commencement of water purification in central India. There are now many sand filtration plants in India.

The Hindus were enjoined to drink the water of the Ganges, as a sacred duty. Cholera and other deadly epidemics depopulated whole districts. When the British officials began to exercise authority, they undertook to remedy conditions wherever they were able so to do, but the superstition and prejudices of the natives were such under their Indian cults, that progress was slow.

In 1893, the Balram Dass Waterworks were constructed at Raipur in the central provinces. Those consisted of an infiltration gallery 100 feet from and paralleling the Karoun River whose level was raised at that point six feet by a dam and its waters percolated the intervening sand layers and weeped through holes into the gallery. Thence they were pumped up through a conduit of masonry and cut through the rock into tanks for distribution. The supply was six and one-half gallons a day per capita. Consult Vol. 143 of Proceedings of Institution of Civil Engineers, pp. 262 et seq., London.

In 1901 the British favored the construction of works for the extension of irrigation from 47,000,000 to 53,500,000 acres.

In 1905 to 1912, they aided in the construction of the Punjab Triple Canal system, which had an excellent effect upon the quality of flowing water for the thousands dependent thereon for drinking purposes. Consult Vol. 201 of Proceedings of Institution of Civil Engineers, pp. 24 et seq.

Prior thereto the inhabitants in that part of India obtained their supply from polluted ponds and other unwholesome sources. The irrigation works of India are extensive and have done something to relieve the deplorable conditions of the millions untutored in hygienic science. All such Indian watercourses as the extensive Punjab Triple Canal system, the Bengal system, the Madras canals, the Ganges and the Indus systems supplied waters for irrigation and formerly to some extent waters for navigation. In a land of such intense heat and extensive barren areas, most of such watercourses supplied all the water obtainable for potable as well as for all other purposes. Slowly the people of the peninsula are beginning to understand some of the causes of the cholera, typhoid and other fatal epidemics that have swept over India from the Buddhist period, commencing 520 B.C. down to recent years. Who can estimate India's mortality directly attributable to its pathogenic-bacteria-polluted water supplies? What costly sacrifices the race has made to its ignorance of and failure to observe the laws of health! Polluted waters are disease producers, as unfailing as the forces of gravity on falling bodies. India with its dense population and appalling pestilential epidemics is an inimitable example of the dreadful results of the use of unwholesome waters for domestic and potable purposes. Modern modification processes have been installed in its principal cities and ports, so the danger of infection in those towns is constantly lessening. In 1914 Bombay consumed 27 gallons, and Calcutta 62 gallons daily per capita. In the waterworks of Calcutta alumino-ferric is used as a purifier, which is an impure sulphate of aluminum. That is generally used as a coagulant elsewhere in India. Mechanical filters at Betmangula, India, reduced the bacteria in Palar River water from 4,350 to 13 per cubic centimeter. The training of some of the river courses, such as the Rangoon, has resulted in the improvement of their waters for domestic uses. Gradually the people are beginning to realize the importance

of preserving their streams and watercourses, including reservoirs, tanks, etc., from pollution.

China and Japan in the past centuries were hardly less oblivious of hygienic and sanitary laws, though less frequently swept by epidemics attributable to waterborne diseases. The Chinese obtain their water supplies from wells, springs and their rivers. There appears to be some natural purification of their waters and less human pollution of them. They are accustomed to boil their drinking water and that disposes of many bacteria.

Japan is abundantly supplied with lakes, rivers and waterfalls and is fast advancing in sanitary science. It has already commenced to adopt some western methods for the purification of its water supplies. George A. Johnson of the United State Geological Survey says: That "the water purification works at Osaka, Japan, having a daily capacity of 25,000,000 gallons, include open sedimentation basins and also sand filters." One was completed in 1903. Bacteria in Yodo River water were reduced from 200 to 25 per cubic centimeter. There is also a slow sand filtration plant at Yokohama, whose water supply is taken from the Sagamigawa. Water purification is also effected to some extent in Tokio, where were consumed in 1914, daily 32 gallons by each of its 1,500,000 residents. It takes its water from the river Tama into the city reservoir at Yodobashi, located high enough to afford nearly 100 feet pressure. There potash alum was used as a purifier. At Kyoto there is a large rapid sand filtration plant.

Melbourne in Australia derives its water supply from the Yan Yean system, consisting of Silver Creek, Wallaby Creek and the Plenty watershed yielding 33,000,000 gallons daily and from the Maroondah or Watts River system yielding 25,000,000 gallons daily, and from Survey Hills yielding 9,000,000 gallons daily. There are six service reservoirs with a combined capacity of 45,000,000 gallons. The daily supply in 1905 was 63 gallons per capita. In 1899 the waters in the service reservoirs and mains carried from 146 to 398 bacteria per cubic centimeter. *B. coli* were found in some reservoirs fed from drainage areas, where there was no sewage and other micro-organisms were also found. That shows how prevalent they may be when least expected. The presence of such bacteria is usually attributable to pollution by sewage. The obtaining of pure and wholesome water is not the least of municipal problems nor of rural communities.

In New South Wales a dozen or more narrow gorges have been dammed and their waters impounded for domestic purposes. So in all inhabited parts of the world, the problem of water supply is of first importance, and is becoming increasingly so as the population increases in density.

Some American City Supplies.— In addition to the municipal supplies already mentioned, the following illustrate the methods adopted in the United States for obtaining wholesome water supplies.

Boston, Mass., is in the Metropolitan Water District, which obtains its supply from lakes and rivers, whose waters are impounded in reservoirs. Cochituate Lake, Sudbury River and the south branch of the Nashua River are its principal sources. The first of these comprises a series of ponds three and one-half miles long, and their waters flow through an aqueduct into Chestnut Hill reservoir, having a capacity of 23,000,000 gallons a day. On the Sudbury River four storage reservoirs, an aqueduct and a conduit were built. They carry 108,000,000 gallons a day, 15.9 miles to the Chestnut Hill reservoir. The waters of the south branch of the Nashua are impounded in the large Wachusett reservoir, at Clinton, having a capacity of 64,500,000,000 gallons in its 6.46 square miles of area. It is 12 miles from the Sudbury reservoir, into which its waters are conducted by the Wachusett aqueduct, and from one of the Sudbury reservoirs by the Western aqueduct built in 1904, to the westerly part of the metropolitan district. The daily capacity of the Wachusett aqueduct is 300,000,000 gallons. The site and shores of the Wachusett reservoir were stripped and that proved satisfactory, for algæ and other plant organisms do not thrive where rock constitutes the bottom and sides of such reservoirs. The water in the reservoirs is not polluted and is remarkably free of organisms, due to the stripping of the sites and the freedom of the catchment areas from pollution, except such as are within the towns of Marlborough and South Borough. *Diatomaceæ* have been found in Lake Cochituate and occasionally small numbers of harmless bacteria in the tap water.

In the Metropolitan Water District of Boston are several other corporations and the supply is metred for different uses.

New York City obtains its water supply from six different sources. Those are with their respective available daily yields: (1) The Croton watersheds with 336,000,000 gallons; (2) The Bronx and Bryan watershed with 18,000,000 gallons; (3) the Esopus watershed with 250,000,000 gallons to be augmented by the Schoharie Creek addition of 250,000,000 gallons; (4) the Long Island watersheds comprising the Ridgewood and other systems, and including Queens (in reserve) with 150,000,000 gallons; (5) the Staten Island watershed, in reserve, with 12,000,000 gallons, and (6) private water companies with 34,000,000 gallons. The foregoing amounts, except that from Schoharie Creek, soon to be added, are given in the instructive paper of Dr. Frank E. Hale, chief chemist of the Department of Water Supply, Gas and Electricity. No other modern system has involved a greater expenditure, except possibly that of London, and none is delivering a greater quantity unless it be that of Chicago. Certainly its quality is as pure and wholesome as that of any city in the world. All its catchment areas are under the supervision of sanitary inspectors and its Catskill supply is largely from lands owned and cleared by the city. Every precaution has been taken to avoid pollution of the sources, and some of which are in the foot-hills and slopes of mountains. Physical, chemical, bacterial and microscopical examinations are periodically made of the various sources.

Several modern processes of purification including liquid chlorine at several plants are in use. They comprise an aerator at the Ashokan reservoir, a coagulation plant above the Kensico

reservoir on the Catskill aqueduct, a Dunwoodie chlorination plant on the new Croton aqueduct, a chlorination plant on the Catskill supply below Kensico reservoir, following aeration, a slow sand filter plant below Oakland Lake in Queens County, whose bacterial efficiency is supplemented by liquid chlorine and several slow and several rapid sand filter plants located on various conduits of the minor sources of supply. One of the latter is at Baisley Pond. Micro-organisms which are destroyed by treatment with copper sulphate, and iron, have been found in some of the waters. The processes used have been efficient in purifying any waters that have been so infested.

and other supplies, including about 96,000,000 gallons of ground waters from Long Island.

In 1918 there were daily distributed for all purposes in all the boroughs of Greater New York approximately 600,000,000 gallons, that being a little more than the rate of 100 gallons per capita.

The waters of the Schoharie Creek or watershed are to be impounded in a reservoir at Gilboa dam, and carried in a tunnel 18 miles long under the Shandaken Mountains into the upper reaches of the Esopus Creek and thence into the Ashokan reservoir to double the present (1919) supply. When that improvement is completed there will be 500 million gallons available a day for New York city, from the Catskill and Scho-

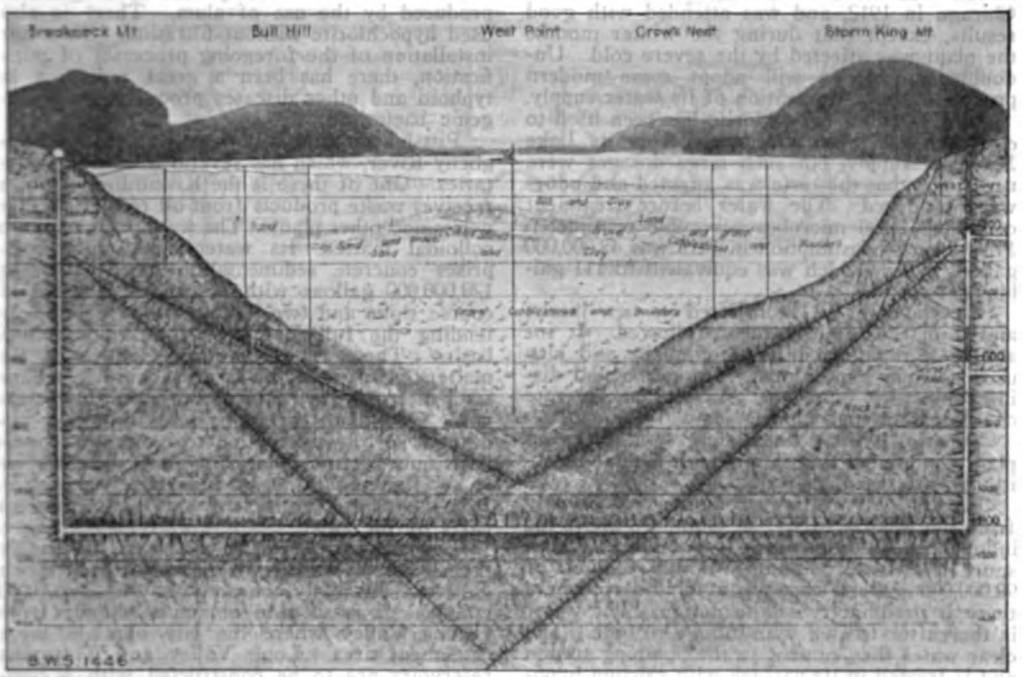


FIG. 2.

Bacteria in the waters of the several Croton and Catskill aqueducts varied from 17 to 68 per cubic centimeter, but chlorination reduced the number from 46 to 91 per cent. In 1918 storage in the Ashokan reservoir reduced *B. coli* 99.8 per cent and other bacteria 69 per cent. Several species of *Diatomaceæ Cyanophyceæ, Protozoa* and *Crenothrix* have been localized in the waters of the New York supply.

The Esopus supply is from several streams, whose waters are conducted into the Ashokan reservoir 91 miles northwest of the city and thence are conducted in an aqueduct having a daily capacity of 500,000,000 gallons down the west side and under the Hudson 1,100 feet below its surface (Fig. 2) and up to the Kensico reservoir, thence to the Hill View reservoir with an elevation of 295 feet, which determines the "head" of the Catskill supply and thence in a tunnel extending down through New York City to the distributing reservoirs in the several boroughs. These receive also the Croton harie watersheds, having an area of 571 square miles. The Ashokan reservoir has an elevation of 587 feet above tide-water and its outlet is 495.5 feet above tide-water. Its capacity is 128 billion gallons. The Gilboa reservoir will have a capacity of 20 billion gallons, and has an elevation of upwards of 1,100 feet above tide water and is 125 miles from New York City.

Albany takes its supply from the raw Hudson River water through screened intakes and passes it through two 18-inch inlets and one 36-inch inlet into a sedimentation basin. After sedimentation, it passes roughing filters into the slow sand filters where the daily rate of filtration is 3,000,000 gallons per acre. It then passes into the covered filtered water reservoirs. Its capacity is 21,000,000 gallons per day and its bacterial efficiency is 99 per cent. The usual bacterial efficiency of slow sand filters ranges from 98 to 99 per cent.

Chicago obtains its daily supply of 1,000,000,000 gallons from Lake Michigan, through nine

intake tunnels, reaching seven intake cribs two or more miles from shore.

In 1915 the Chicago Board of Experts reported that its water from Lake Michigan was turbid, polluted and unsafe for drinking purposes. The opening of the Drainage Canal in 1901 to send the flow of sewage down the Illinois River lessened the pollution of near shore lake waters, but did not wholly remedy the difficulty. City sewage still flows to a limited extent into the lake and pollution continues. The problem is a serious one for Chicago as it is for all other cities similarly situated. The intakes of other Great Lake cities, however, are not so near the effluents of their sewage and there is less direct pollution therefrom. Chlorination was tried in one of the districts in Chicago in 1912, and was attended with good results, except that during the winter months the plant was affected by the severe cold. Undoubtedly Chicago will adopt some modern process for the sterilization of its water supply.

In Milwaukee hypochlorite has been used to eliminate gas-forming bacteria from its Lake Michigan supply, but such large dosages were necessary, that the taste was affected and odors were produced. The water before treatment contained 2,590 microbes per cubic centimeter. Milwaukee's consumption in 1915 was 48,000,000 gallons a day, which was equivalent to 111 gallons per capita.

Cleveland in 1911 completed its new intake and a marked improvement followed. It installed a rapid sand filtration plant and also used calcium hypochlorite as a germicidal disinfectant. Its supply in 1912 was at the rate of 133 gallons per capita a day.

Superior, Wis., has a slow sand filtration plant comprising three units with a total capacity of 300,000 gallons a day.

Kansas City, Missouri, obtains its supply from the Missouri River at Quindaro above the inflowing polluted Kansas River. The raw Missouri River water is pumped into a reservoir of 90,000,000 gallons capacity at Quindaro where there is preliminary sedimentation. The water is thereafter treated with alum and lime. The clear water then returns to the pumping station and is treated in its passage with calcium hypochlorite and aerated. It is then pumped into Turkey Creek reservoir, where a high pressure service is maintained and thence it is let into the mains. The raw river water in 1911 contained as high as 30,000 *B. coli* per cubic centimeter and they were reduced by such treatment as stated to less than 100 per cubic centimeter, which is the standard of purity established in 1914 by the Treasury Department of the United States Government. The purification at Kansas City, Mo., whereby large colonies of pathogenic bacteria in its raw river water supply were eliminated, well illustrates how Missouri River water may be purified and made safe for potable uses.

Buffalo obtains its supply from Lake Erie and it is purified by chlorination at the intake pier in Lake Erie. The daily consumption is approximately 125,000,000 gallons.

New Orleans obtains its supply from the Mississippi River. A Sewerage and Water Board was created in 1899 and aerial cisterns were ordered closed. They were breeding places of the *stegomyia* which cause yellow fever. In 1909 a new rapid sand filtration plant was installed having a daily capacity of 40,000,000 gallons and the water was first put through sedimentation aided by sulphate of aluminum and ferrous sulphate as coagulants. In 1910 the rate was 5.99 million gallons per acre per day. New Orleans has two filter plants, namely the Carrollton Filters and the Algiers Filters. From an official report it appears that the rate of filtration through the former in 1914, was fivefold that of the latter. In 1915 the daily consumption was 20,000,000 gallons, which was at the rate of 57 gallons per capita.

Omaha, Neb., obtains its supply from the Missouri River which requires purification. Accordingly a series of basins were constructed for sedimentation of much of the suspended matter. That was accompanied by coagulation produced by the use of alum. There is also used hypochlorite without filtration. Since the installation of the foregoing processes of purification, there has been a great reduction in typhoid and other diseases produced by pathogenic bacteria.

Pittsburgh obtains its supply from the Allegheny River, which has several inflowing tributaries. One of these is the Kiskiminetas which receives waste products from oil refineries, tanneries and other plants. The water carries much colloidal matter. Its waterworks plant comprises concrete sedimentation basins, holding 120,000,000 gallons with 24 roughing filters of coarse stone and two hollow frame baffles, extending the full length of the sedimentation basins. These rid the water of much of the matter in suspension. It also comprises slow sand filters and a covered filtered water reservoir. The plant is unique and illustrates another type of construction to overcome conditions quite extraordinary. Its service reservoir is at Highland Park 367 feet above the river. It has several reservoirs for service in different parts of the city.

Los Angeles formerly obtained its supply from ground waters by means of infiltration galleries. Its daily consumption was 26,000,000 gallons. It is soon to obtain its supply from Owens Valley where the city owns a large catchment area. Long Valley and Tinemaha reservoirs are to be constructed with a combined capacity of 150,500,000,000 gallons. The aqueduct consists of open canal sections, masonry sections and tunnels and several intercepting reservoirs, each of many million gallons capacity which regulate the flow and develop power. It is so constructed that ground water near the surface may be pumped into it and augment its volume. It has 23 inverted siphons and serves both for water supply and power purposes and is one of the large water supply projects on the Pacific Coast.

San Diego has a municipal pressure filter of 5,000,000 gallons capacity.

San Francisco is supplied by five independent systems owned by a private corporation. The waters are drawn from artesian wells.

In June 1919, Sacramento decided to install a modern filtration and pumping plant with filter beds of 30,000,000 gallons daily capacity and is to use sulphate of aluminum as a coagulant. Its water supply is from river water, mountain sources and from wells.

In addition to those already mentioned, purification plants have been constructed at Wil-

to 153 gallons for each of its 600,000 inhabitants.

The republics of South America are likewise appreciating the necessity of providing pure water for their inhabitants. In 1867–68, there was an epidemic of cholera in Buenos Aires, Argentina, which had 1,500 victims, and in 1871 yellow fever followed, which had 2,600 victims, both due to unsanitary water supply. Aroused by this condition the city employed eminent engineers and constructed a system of modern waterworks. The city obtains its water from the Estuary at Belgrano. It is then conducted three and one-half miles to Recoleta, where there are settling basins of 12,000,000 gallons capacity and six acres of covered filters. The filtered water is then pumped to great distributing reservoirs at Colles Cordoba and Viamonte, which cover an area of four acres and have a capacity of 13,500,000 gallons. Buenos Aires now has a good water supply. Argentina is enforcing hygienic regulations in all of its coast cities.

Rio de Janeiro obtains its waters from mountain sources. The waters are conducted into receiving reservoirs and then are carried 33 miles from their sources through conduits to distributing reservoirs, in the course of which there is some purification.

The foregoing will suffice to show the world-wide interest now being taken in water supplies and the researches of scientists and efforts that have been made and are being put forth by all progressive communities to secure for themselves pure and wholesome water for potable and other domestic purposes.

Enough has already been said to demonstrate the vital importance of water supplies to communities and to individuals. In this article the problems involved in the construction of waterworks have not been discussed for they are engineering problems and do not come within its scope. The larger and more important problems of water supplies, however, have been presented at some length in order that readers of the ENCYCLOPEDIA AMERICANA may understand what is involved in obtaining such supplies and the menace to health and to life in drinking impure water.

There is always the possibility that the purification of municipal water supplies may be incomplete or that contamination may ensue from private wells or other auxiliary supplies into water mains forbidden in New York except with the approval of the Board of Health or may be contamination may ensue from sewage or other subterranean pollution in cities, so that pathogenic bacteria may still exist in public water supplies, as they may exist in well waters and in all other kinds of raw waters. Such menace to health may be avoided, however, by the installation of approved purification processes in private dwellings, hotels, hospitals, schools, offices, factories, etc.

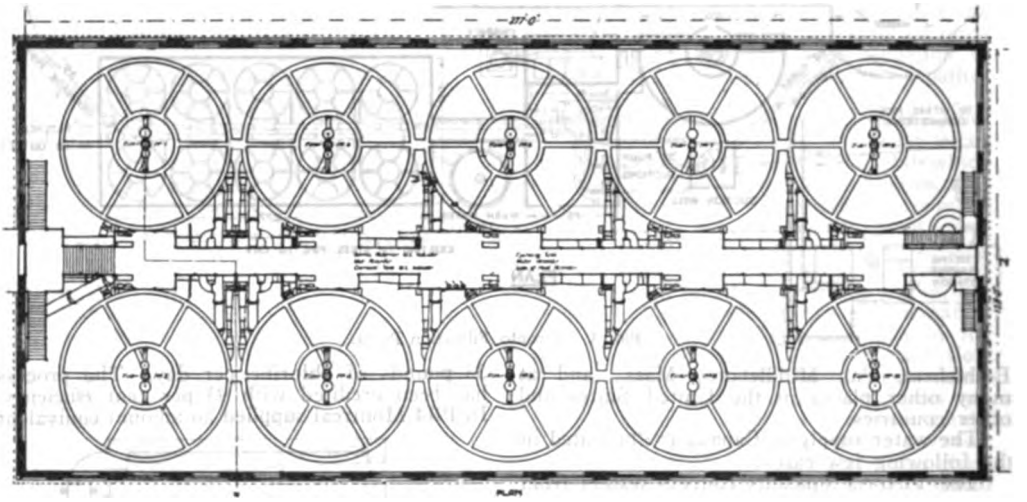


FIG. 5.—Toronto Filtration Plant — General Arrangement of Pipes in Filter House.

The matter is of such transcendent importance that the Treasury Department of the United States Government called together a corps of distinguished specialists in 1914, and they formulated standards of purity for water to be consumed by the public, which was being supplied by common carriers in interstate commerce.

The article is contributed in the hope that it may awaken a deeper interest in the subject than that taken by individuals and communities which have suffered most seriously from unwholesome water supplies in the past.

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WATER TABLE, *in architecture,* a projecting stone sloped on the roof to throw off water. It occurs in buttresses and other parts of Gothic architecture.

WATER THERMOMETER. See THERMOMETER.

WATER-THRUSH, an American warbler of the genus *Seiurus,* brownish to yellowish in color, having terrestrial habits and frequenting preferably the borders of streams; its domed nest in the woods gives the name oven-bird to the common resident species (*S. auricapillus*). The Louisiana variety (*S. motacilla*) is distinguished by a white superciliary line. See WARBLERS; WAGTAIL.

WATER TURBINE. See TURBINE; WATER WHEEL.

WATER-TURKEY. See DARTER.

WATER VALLEY, Miss., city, one of the county-seats of Yalobusha County, on the Illinois Central Railroad, about 140 miles north by east of Jackson, the State capital, and 15 miles north of Coffeeville, the other county-seat. It was settled in 1855 by William Carr; incorporated in 1867, and chartered as a city in 1890. It is in an agricultural region, in which cotton is one of the principal products. It has considerable lumbering interests. The chief manufacturing establishments are cotton mills, railroad repair and construction shops, in which there are 500 men employed, a lumber mill, foundry and machine shops, and woodworking factory. The city owns and operates the electric-light plant and the waterworks. There are seven church denominations, the Methodist State Orphans' Home, the McIntosh Training School, and public schools for both races. There are two banks and two newspapers. The government is vested in a mayor and board of aldermen consisting of seven members elected every two years. Pop. 4,708.

WATER WHEEL, a machine by which the energy in falling water is utilized to perform mechanical work. Water, through its tendency to seek the lowest level — the point nearest to the centre of the earth — acts as a motive power by its weight. When the water is confined, as in a vertical pipe, this weight becomes pressure. When the water has acquired a velocity in flow its motive power is called impulse. Water wheels adapted to these various conditions may be divided into two general classes — the "vertical," consisting of the "overshot," "breast" and "undershot" wheels; and the "horizontal," which includes a great variety of turbine or reaction wheels. The impact or impulse wheels are represented in both classes. The term water wheel is correctly applicable to all forms of water motors that rotate, but in this article it will be restricted to those of the vertical class. For those belonging to the horizontal class, see TURBINE.

The overshot wheel is so called because the actuating water is fed to it from the top. It is provided with a number of buckets fixed to its periphery in such a way that as the wheel revolves the buckets on the descending side have their tops upward, and being filled with water at or near the top of the wheel, the weight of the water exerts a downward pull and the axle of the wheel being free to turn in its bearings, a rotary motion is imparted to the axle from

which it is transmitted by belts or gearing to the mechanism to be operated. The water is admitted to the wheel by various methods, such as the overfall sluice, the penstock and the guide bucket, in all of which the water is guided in a course tangential to the perimeter of the wheel. If the water is in motion, that is, has a certain velocity, when it enters the wheel buckets, it acts partly by impact, but in usual conditions the motive power of the wheel is simply the weight of water in its descending buckets, which may be roughly estimated as the cubic content in feet of two-thirds of the number of buckets, multiplied by 62½ pounds. To obtain the greatest efficiency, the number of buckets, ought to be as large as possible and so arranged as to hold the water as long as practicable. The buckets vary in form, but the greatest effect is obtained from curved buckets, the "radial" giving only about 75 per cent of the power obtainable by the use of "elbow" buckets. Overshot wheels may be constructed of wood or iron in any size. The earlier forms were massive structures built of wood; the modern wheels are generally built of iron and are practically limited by construction problems to falls less than 60 feet in height. The average sizes range from 8 to 40 feet in diameter.

In the breast wheel the water is received by the buckets on a level with or but slightly above the axle of the wheel. It is most effectively employed in connection with falls ranging from 5 to 20 feet, and where the flow ranges from 5 to 90 cubic feet per second. The buckets are generally held in a curb, and, not being required to hold water, are set radially. Their number is made as large as possible, and they are set at such an angle that they leave the water vertically so as not to carry up water from the tailrace. The breast wheel is more effective than the overshot where the fall is low, since it can be made of nearly double the diameter and affords an increased facility for the reception and discharge of the water by the buckets, besides gaining some power from impulse.

The undershot wheel receives the water below its horizontal centre line. Instead of buckets it is equipped with a series of paddles or vanes fixed to the periphery in such a way that the flowing water passing under the wheel pushes against the paddles, causing rotation. It is usually set in a curb with a minimum amount of clearance for the escape of the water. The most effective curbs are concentric to the wheel, those set straight or tangential allowing too much waste. The paddles are set radially and inclined upward in order to be readily emptied of water upon the return side.

For falls not exceeding six feet, the most effective wheel is the Poncelet. In it the water acts in a manner very similar to its action in a turbine, and although not quite as efficient as turbines working under normal conditions, it is superior when working under a reduced water supply. The buckets are curved, and the water flowing along their concave sides presses upon them without impact and with greater effect than that of water impinging at right angles against buckets with plane surfaces. The effect of the wheels increases with the depth of the water, and the velocity of rotation is equal to about one half the velocity of the flowing water. The simplest form of the "impact" wheel consists of a series of rectangular buckets fixed upon a wheel at an angle varying from 50 to 70 degrees to the horizontal. The water is conducted to it through a pyramidal flume set at an angle varying from 20 to 40 degrees, so that it strikes the blades nearly at right angles. The normal effect is about 5 per cent of the total mechanical power of the flow, but this may be increased somewhat by increasing the length of the paddles, so that the water exerts a combined impinging and pressing force.

In another form, known as the "impulse" wheel, a series of cup-shaped buckets attached to the periphery of the wheel are acted upon by a jet of water conducted by a pipe and delivered through a nozzle tangentially against the cups. More power is obtained by increasing the number of nozzles to two, or even four. Of this form the most notable are those of the Pelton type, which are extensively employed to work air compressors in mining operations. At first limited in usefulness to the locality of the power, the development of electric power transmission brought them into a greatly enlarged field of service. Such wheels are now operating under heads up to nearly 2,000 feet. A Pelton wheel in the service of the South California Edison Company, working under 1,900 feet head at 430 revolutions per minute, develops 1,600 horse power. This wheel has been running continuously since 17 March 1903. At a plant recently erected in Europe, a jet of water one and one-half inches in diameter under a head of 5,250 feet develops 3,000 horse power. The Rio Janeiro Traction, Light and Power Company operates a Pelton wheel with four nozzles under 900 feet of head. The power developed is equivalent to 20,000 horse power.

The efficiency of the turbine being so much greater than that of any type of vertical water wheel they are universally preferred except in the smallest water power developments. This statement, however, does not apply to the Pelton wheel whose efficiency is equal to the turbine, and is available where the head is too great for economical use in turbines. The largest vertical water wheel ever built in America was the Burden wheel, located on the bank of Wynant's Kill, which enters the Hudson River near Troy, N. Y. This wheel was of tension construction, the 264 spokes being one and one-half inch rods bolted to rosettes on the 12 inch shaft. Its diameter was 60 feet, and its face width was 20 feet. The water was brought to the wheel through a steel penstock which crossed the wheel transversely at its summit. Four gates at intervals in this penstock were in the constant charge of the wheelman who opened or closed them so as to keep the supply such that it would turn the wheel at a constant speed of two and one-half revolutions per minute. On the outer sides of the rim were circular cogged racks which engaged with pinions seven feet in diameter and nine inches face keyed to the shaft, which projected 31 feet into the mill. This wheel was in constant operation 45 years, much of the time running night and day for long periods. It was abandoned in 1898 as of insufficient power for the needs of the business, but remained intact for 15 years thereafter before it began to fall into decay. The largest water wheel in the world is that which supplies the ancient city of Hama with water for drinking and irrigation from the river Orontes—

about 120 miles north of Damascus. This wheel is of the undershot type, 70 feet in diameter and of comparatively narrow face. It is built of wood upon an iron axle.

Bibliography.— Good descriptions of water wheels are scattered through the various engineering periodicals. Especially valuable data may be obtained from 'Transactions of the International Engineering Congress' (San Francisco 1916). See also TURBINE; WATER POWER; WATER MOTOR.

WATER AND WHITE ALDERS. See CLETHRA.

WATER WORSHIP, a feature of nature worship, and one of the primitive superstitions of mankind. Water was not worshipped as an element, but in its various forms of well and spring, river and ocean. Every spring and river was supposed to have an animating deity, who could be propitiated or offended, and the worship of these divinities was a prominent part of Greek and Roman cult, especially in the rural districts.

WATERBORO, wâ'tĕr-bŭr-ō, Me., town in York County, on the Portland and Rochester Railroad, about 25 miles southwest of Portland. It contains the villages of Waterboro, East Waterboro, South Waterboro, North Waterboro, Waterboro Centre and Ossippee Mills. It was settled in 1787, and in 1789 was incorporated. The town has flour and lumber mills, an apiary for breeding bees and considerable dairy interests. Pop. 997.

WATERBURY, a city of Connecticut, in New Haven County, the fourth in population in the State, and one of the most important manufacturing centres in New England. It is situated on both sides of the Naugatuck River, 21 miles above its junction with the Housatonic, 22 miles northwest of New Haven and 32 southwest of Hartford. In January 1902, by an amendment to the charter, the city became coterminous with the town, so that it now covers an area seven or eight miles square. Its physical features are greatly diversified. Its streams and wet lands probably suggested its name, given to the town at the time of its incorporation. Its earliest designation, "Matetacoke" (shortened to Mattatuck), means a place or land without trees, and had reference probably to the primæval meadows on the Naugatuck.

History.— The first attempt at a settlement was made in 1674, by men of Farmington, on the high land west of the river, known ever since as the Town Plot. The breaking out of King Philip's War led to the abandonment of this site and the planters, when they returned, settled on the east side of the river, nearer to Farmington, calling the place the Town Spot. The settlement was formed under the order of the General Court, upon the payment of about £2,500. The men numbered 31, and for 26 years no outsider was admitted as a proprietor. Mattatuck was incorporated as a town (of Hartford County), with a change of the name to Waterbury, in 1686, occupying then a territory about eight miles wide and 18 miles from north to south.

For more than a century its growth was slow. In addition to the natural disadvantages of the situation, there were such disasters as the "great flood" of 1691 and the "great sickness" of 1712. The organization of a church — always an important event in a New England plantation — did not take place until 1691. The town and parish were identical until 1738, when Westbury (now Watertown) was set apart as an ecclesiastical society. Northbury (now Plymouth and Thomaston) secured similar rights in 1739, and thenceforth the original parish became known as the First Society. The church belonged, of course, to the Congregational denomination. No other existed in the territory until 1737, when Episcopal services were introduced. The town was represented in the Revolutionary War by about 800 men, an extraordinary number.

Throughout its history, Waterbury has suffered seriously from fires. The losses in 1880–81 and in 1892–94 were exceptionally large, but were far surpassed by those of the great fire of 1902, which amounted to more than $2,000,000. A fire company was organized in 1828 and several others later, and a fire department was established under the first city charter in 1854. This has developed, much after the fashion of other cities, into a paid department, with a chief engineer, and equipped with a modern automobile apparatus.

Manufactures, etc.— The conditions that surrounded the settlement of the town and limited its agricultural prosperity became an important factor in its subsequent development. Under the discipline of poverty and hardship, a group of men grew up who possessed inventive genius, and, in addition, patience, economy and pluck. When the manufacturing era opened, these men were at the front, ready to make use of their opportunities, while the rapid streams of the region furnished the necessary water power. The farmers' sons became manufacturers — makers of clocks and buttons — and along the several streams little factories and mills grew up, whose products met the growing demand of the time. It was in response to this demand, emphasized by the War of 1812–15, that the brass industry of Waterbury received its early impetus — an impetus which was enhanced anew, and very greatly, by the War for the Union. By 1840 the manufacture of sheet metal and wire had taken the lead of all others. But there were many uses to which sheet brass could be applied beside button-making, and Waterbury manufacturers were quick to discover them. The great manufactories are still known locally as "rolling mills," but the articles produced in them are of endless variety. Through the latter half of the 19th century the bulk of the brass manufacture was carried on by six concerns, one of which came into existence in 1802, and another a few years later. These six manufactories still hold their prominent position, but meanwhile others have sprung up and attained to great importance, some devoted to one specialty and some to another, and several of them rivaling in the extent of their product the older establishments. Buttons, buckles, pins, hooks and eyes, suspenders, harness trimmings, rivets, wire, tubing, gas fixtures, lamps, brass kettles, boilers, clocks, watches, spoons, forks, flasks, percussion caps, photographic materials, coins for South American republics — things of all kinds made wholly or in part of brass — are sent forth from their packing rooms by hundreds of thousands, and shipped to all parts of the world. The chief seat of the brass industry in America is the Naugatuck Valley, and Waterbury is its dominant

centre. There are also many important establishments quite outside of the brass industry — machine shops of national reputation, foundries, manufactories of cutlery, of hinges, of traps, of aluminum goods, paper-box factories and various others. The number of Waterbury concerns which organized under the "Joint Stock Law" of Connecticut between 1843 and 1911 was about 300. One hundred of these were companies working in metals; the rest were corporations manufacturing other materials, or mercantile and miscellaneous concerns. Many of these have ceased to exist, but the surviving corporations number over 150. The fame of the Waterbury watch was worldwide, yet few people know that one of the largest clock factories on the globe is here. In 1845 the capital employed in manufactures amounted to $653,-825; in 1890 the amount of the capital was $17,-682,500, and the value of the product, $17,712,-829; and, in 1910, the amount of the capital was $35,000,000, the value of the product $50,350,000, and the total wages paid $12,000,000. In 1914 the capital was $49,000,000 and the gross products almost $51,000,000. Waterbury, having manufactured munitions during the War of 1812, and during the Civil War, again turned to the manufacture of war materials in 1914, and continuously during the World War has turned out munitions to the extent of tens of millions of dollars.

Through all this period Waterbury men were busy as inventors. The first United States patent was granted to a descendant of a Waterbury miller; the second was granted to a resident of Waterbury — in 1796. The number of patents issued to residents of Waterbury continues to be about double what might be expected from the population; or one annually for every 500 inhabitants. The city has six commercial and seven savings banks.

Railroads and Transportation.— Electric cars run through the main streets and beyond the city limits in every direction to the neighboring towns. The headquarters of the western division of the New York, New Haven and Hartford Railroad are in Waterbury and express train service is given both to New York and Boston with local service on branches extending to Middletown, to New Haven and to Watertown. The electric trolley railway system centring here serves 42 towns within a radius of 35 miles. The product of the Waterbury manufacturers in the line of mailable goods is so immense that the business of the post office is exceptionally large. The money order business amounts to nearly a million dollars annually.

Water Supply, Lighting, etc.— The water supply is abundant and good. A reservoir was established on East Mountain in 1868, another on Cooke street in 1880, the Wigwam Reservoir in 1901, and in 1909 the building of the Morris Reservoir on the west branch of the Naugatuck, 11 miles north of the city, was begun. These reservoirs have a total capacity of over 5,000,000 gallons of water. There are 95 miles of water pipe. A sewerage system was introduced in 1883, but the discharge of sewage into the river was strongly objected to by persons and establishments located below the outfalls. In August 1904 the city began the building of a trunk sewer, and a sewage disposal plant some miles down the valley. The city has been lighted by gas since 1854. Electric lights were introduced in 1884, and were substituted for gas lights on the public streets not long after. Since 1904 the current which supplies the lights and also furnishes the motive power of the trolley system is brought across the country from the Housatonic River.

Streets, Parks, Buildings, etc.— The city is divided into four sections, as the town has been from its settlement, by two main streets, one running east and west, the other nearly north and south. There is also an informal division into districts, some of which represent the school districts of the earlier time. The most important of these are Brooklyn, Waterville, Hopeville and Bunker Hill. At the intersection of the main streets there is a central park or green, adorned with stately elms, at one end of which stands an elaborate soldiers' monument (erected in 1885, by popular subscription), and at the other end a handsome drinking fountain. The development of Hamilton and Chase Parks — valuable gifts to the city — was begun in 1903. Centre square and Union square are attractively laid out. The public buildings worthy of mention are the courthouse, the post office, the Bronson Library, Second Congregational Church, Saint John's Church (Episcopal), Saint Patrick's Church (R.C.), the building of the Young Men's Christian Association, the Girls' Industrial School, the Lilley building, the Citizens' Bank, the Elton Hotel and the Buckingham building, Saint Anne's Church (R.C.). The municipal building adjoining Library Park cost $600,000. There are 23 theatres. The union railway station is modern and commodious. The Chase Interests, Inc., have just built an edifice costing approximately $1,000,000, to be used for office purposes.

Education, etc.— School affairs were at first conducted by the town, and afterward by a "school society," which divided the town into 14 districts. In 1849, chiefly with a view to establishing a high school (the old academy having suffered a decline), five of the districts were incorporated as a centre district, under the management of a board of education, a finance committee and a superintendent of schools,— leaving a circle of outlying districts under the old management (a board of school visitors). In 1899 the bounds of the city were extended and made coterminous with those of the centre district, and the earlier and somewhat cumbrous organization was superseded by a department of education, consisting of the mayor and a board of seven members. In 1917 the board consisted of the mayor and nine members, three members being elected for terms of six years each. When, in 1902, the city was finally made coterminous with the town, the traditional status of the outlying districts was preserved. The districts have since practically been abolished. The investment in public schools exceeds $3,000,000.

Kindergartens, domestic science, manual training and sewing departments have been established in all of the schools, and the evening schools have been conducted since 1856. A continuation school for machine shop apprentices has been established. An open-air school was established in 1912. The first high-school building was destroyed by fire in 1870; the third was erected in 1895–1911 at a cost of $225,000. Two new high schools have been erected at a cost

lower level. When the water falls over a precipice it is called a cataract, and when several cataracts occur in succession it is called a cascade. Where the incline is less steep and there is merely a stretch of very swift and tumbling water, the term rapid is commonly used. Some of the mountain waterfalls are remarkable for their height, while others are noted for the fall of immense quantities of water. The most remarkable waterfall in the world is Niagara Falls on the Niagara River, between lakes Erie and Ontario, and thousands of visitors from all parts of the world have admired the sublimity of these falls. Waterfalls are now being utilized to furnish both electric and water power for commercial purposes. The falls discovered by Dr. Livingston in Africa and named by him Victoria Falls, the falls of the Ruikanfoss in Norway, the Cascade of Gavarnie in the Pyrenees and the falls of the Rhine are among the most beautiful in the world, and justly celebrated. Falls are characteristic of a youthful stage of river erosion, and are usually caused by unequal hardness of the rock, the softer being worn down the faster, and giving rise to inequalities in the river bed. After the softer beds are cut down as low as they can be eroded, the rivers more slowly cut away the harder layers, and the fall gradually disappears. For a fuller description see CATARACTS.

WATERFORD, Conn., village and township in New London County, three miles southwest of New London, on the New York, New Haven and Hartford Railroad. There are granite quarries and manufactures of paper. Pop. 3,097.

WATERFORD, Ireland, capital of County Waterford and a county city, about 100 miles southwest of Dublin, on the right bank of the Suir, connected with its north suburb of Ferrybank by a bridge. Of six Catholic places of worship, including a cathedral, the finest is the Dominican Church of Saint Savior, erected (1878) in the Italian style; the Protestant Episcopalians have also a cathedral and two churches. Other buildings are the Protestant Episcopal palace, the Catholic College of Saint John, Saint Dominic's Industrial School, four convents, a town hall, market house, etc. Considerable sums have been expended in deepening the channel of the Suir, whose south bank is fringed for a mile by a spacious quay, while on the Kilkenny side is a shipbuilding yard, with a patent slip, graving bank and dock. Besides two immense bacon-curing establishments, Waterford has iron foundries, flour mills, breweries, etc. A memorial of Waterford's foundation by the Danes in the 9th century is "Reginald's Tower" (1003), which has witnessed the city's capture by Strongbow (1170), the repulse of Cromwell and surrender of Ireton (1649–50) and the embarkation of James II after the battle of the Boyne (1690). Pop. 27,000.

WATERFORD, N. Y., village in Saratoga County, on the Hudson River at the mouth of the Mohawk River and on the Champlain Canal and the Delaware and Hudson Railroad, two miles above Cohoes and 10 miles north of Albany. It has extensive water power and is a manufacturing village. The chief manufactories are knitting mills, foundry and machine shops, fire-engine shops, paper and flour mills, boiler works, shirt and collar factories and a furniture factory. The value of the finished products exceeds $3,000,000 annually. It has a union free school, public and parish elementary schools, free library, two newspapers and one private bank. Pop. about 4,000.

WATERHOUSE, Alfred, English architect: b. Liverpool, 19 July 1830; d. London, 22 Aug. 1905. He studied architecture under Richard Lane in Manchester and afterward in France and Italy. He began practice in Manchester in 1853 and first made his name known by the Assize Courts of that city. For the same city he afterward designed the county jail, Owens College, the town-hall, Saint Mary's Hospital and other buildings. In other parts of England he was responsible for the following among other buildings, in Liverpool, Seaman's Orphanage, Turner Memorial Home, Royal Infirmary and University College; in London, Natural History Museum, New Saint Paul's School, City and Guilds Central Institution, King's Weigh House Chapel and University College Hospital; in Oxford, Balliol College (partly rebuilt); in Cambridge, Caius and Pembroke colleges (partly rebuilt); in Leeds, Yorkshire College; the mansions of Eaton Hall (Cheshire), Heythrop (Oxford), and Iwerne Minster (Dorset). He was elected A.R.A., in 1878 and R.A., in 1885, and in 1898 became treasurer of the academy. He received a Grand Prix from the Paris exhibition of 1867 and was a member of various foreign academies. In 1878 he was awarded the gold medal of the Royal Institute of British Architects, of which he was president 1888–90.

WATERHOUSE, John William, English painter: b. Rome, Italy, 1849. He studied at the Royal Academy and his paintings are noted for the richness of their coloring. His paintings include 'The Oracle' (1884); 'The Magic Circle,' 'The Lady of Shalott,' 'La Belle Dame sans Merci,' 'The Soul of the Rose' and 'Thisbe.'

WATERLAND, Daniel, English clergyman: b. Lincolnshire, 14 Feb. 1683; d. 23 Dec. 1740. He studied at Cambridge, became master of Magdalen College, chaplain to George I and canon of Windsor. Waterland was an able defender of the Orthodox faith against the Deists. His chief writings are 'A Vindication of Christ's Divinity, being a Defense of some Queries relating to Dr. Clarke's Scheme of the Holy Trinity' (1719), followed by a second (1723) and third (1725) 'Vindication'; a 'Critical History of the Athanasian Creed' (1724), also directed against Clarke; 'Christianity Vindicated Against Infidelity,' a reply to Tindal's 'Christianity as old as the Creation'; and a 'Review of the Doctrine of the Eucharist' (1737), directed against Hoadley's rationalistic theory of that ordinance. Consult Van Mildert, 'Life of Daniel Waterland' prefixed to Waterland's 'Works,' in 6 vols. (1843).

WATERLOO, Stanley, American author and journalist: b. Saint Clair County, Mich., 21 May 1846. He was graduated from the University of Michigan in 1869, engaged in journalism, was one of the owners of the

Saint Louis *Journal* in 1872, was subsequently editor of the Saint Louis *Republic*, *Chronicle*, and *Globe-Democrat*, and in 1884 established the Saint Paul *Day*. He was later editor-in-chief of the Chicago *Mail*, and has been engaged on various other journals. He has written 'A Man and a Woman' (1892); 'Honest Money' (1895); 'These are My Jewels' (1902); 'The Cassowary' (1906), etc.

WATERLOO, Canada, (1) a town of Waterloo County, Ontario, two miles northwest of the capital, Berlin, on a tributary of the Grand River, and on a branch line of the Grand Trunk Railway to Elmira. It is an industrial centre, with iron foundries, manufactures of agricultural implements, boots and shoes, brooms, textiles and tobacco and a newspaper. Pop. 4,800. (2) The capital of Shefford County, Quebec, and a railway junction, on the Stanstead, Shefford and Chambly Railway, 70 miles east by south of Montreal. It has lumber and flour mills, a brewery, tanneries and manufactures of mill-machinery, agricultural implements, iron castings and furniture. There are two newspapers and two banks. Lumber and farm produce are shipped. Pop. about 2,000.

WATERLOO, England, a town and watering-place of England, on the Lancashire Coast, four miles north-northwest of Liverpool, forming with Seaforth one urban district. Pop. 27,000.

WATERLOO, Ill., city, county-seat of Monroe County, on the Mobile and Ohio Railroad, 24 miles south of Saint Louis, Mo. It is in a fertile agricultural region, in which the chief products are wheat and corn. In the vicinity are quarries of fine building stone, known in the trade as Waterloo marble. The chief manufacturing establishments are flour mills, marble works, a large brewery, an ice factory and bottling works. There are large stock yards and coal and lumber yards. The educational institutions are a high school, founded in 1891, Saint Joseph's School (Roman Catholic), public and parish elementary schools and a school library. There are two banks and two newspapers. Pop. 2,091.

WATERLOO, Ind., town in De Kalb County, on the Cedar Creek, and on the Lake Shore and Michigan Southern Railroad, 28 miles north by east of Fort Wayne. It is the commercial centre of an extensive agricultural section, in which wheat, corn and vegetables are the chief products. It has seven churches, a high school, founded in 1872, graded elementary schools, two banks and a newspaper. It was founded in 1857, and in 1864 was incorporated. Pop. 1,167.

WATERLOO, Iowa, city, county-seat of Blackhawk County, on the Cedar River, and on the Illinois Central, the Chicago, Rock Island and Pacific and the Chicago, Great Western railroads, about 95 miles west of Dubuque. It is in an agricultural and stock-raising region, and has considerable manufacturing interests, partly due to abundant and cheap water power. The chief manufacturing establishments are foundries, machine shops, gas-engine works, threshing-machine factories and automobile works, manufactories of refrigerators, farm implements and the Illinois Central Railway repair shops. Their annual gross products are valued at about $4,000,000. The principal public buildings are the government building, the county courthouse, municipal buildings and the Presbyterian Hospital. There are 31 church buildings. The educational institutions are two public high schools — the East High School, founded in 1872, and the West High School, in 1870; Our Lady of Victory Academy (Roman Catholic), public and parish elementary schools, Waterloo Business College and school libraries. There are seven banks and two daily newspapers, besides monthly and semi-monthly periodicals. The government is vested in a mayor and a council of eight members elected biennially. The majority of the inhabitants are American born; of the foreign born the Germans predominate, then the Irish and the Scandinavians. Waterloo was settled in 1845–46 by G. W. Hanna and Charles Mullan. It was incorporated as a town in 1868. Pop. 38,000.

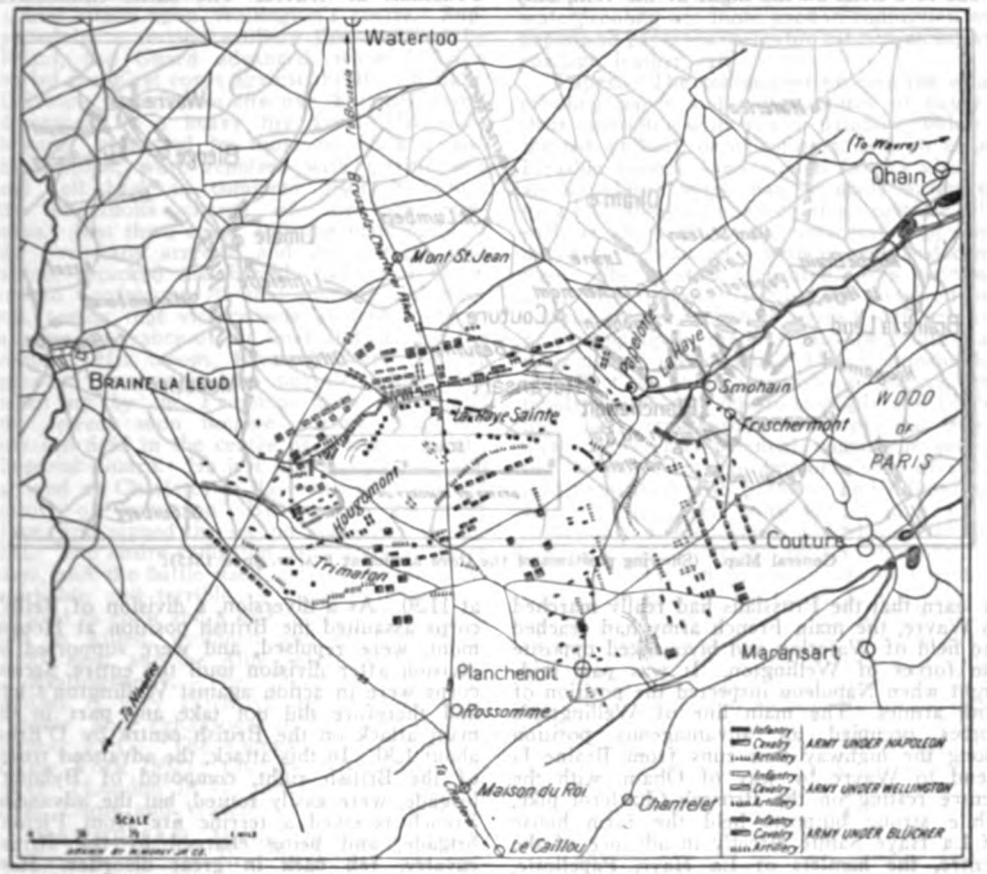
WATERLOO, N. Y., village, one of the county-seats of Seneca County, on the Seneca River, the Cayuga and Seneca Canal and on the New York Central and Hudson River Railroad, about 18 miles west of Auburn and 55 miles east of Rochester. It is in an agricultural region, but the village has several manufactories, chief of which are large woolen mills, lumber mills, piano factories, wagon and carriage works. It has a high school founded in 1843, public elementary school and a public library. There are two banks and three newspapers. Pop. 4,343.

WATERLOO, Battle of, the culminating engagement of the shortest and most decisive of all of the Napoleonic campaigns, was fought 18 June 1815, near the village of Waterloo, in Belgium, situated about 12 miles south of Brussels. From 11 April 1814, when Napoleon signed the first abdication and retired in exile to Elba, until 20 March, when he terminated the period of that retirement and returned to Paris, the political and domestic affairs of France had been bordering on revolution. Although the administration of affairs by the government established by the Comte du Provence, who, under the title of Louis XVIII, had taken unopposed possession of the country, restored political liberty, the changes inaugurated were so sudden, that it unsettled all domestic affairs, the title of estates, the position of public men, and the prospects of the army to an intolerable extent. A general sense of alarm and humiliation prevailed among all classes, and even a Napoleonic period seemed preferable to the existing conditions. To add to the general turmoil, about 300,000 troops who had been held as prisoners in the various German fortresses were released under treaty stipulations and returned to France. Their apparent availability for further operations soon formed the basis for innumerable military plots of which that designed by Fouche, with the ultimate object of placing either the Duke of Orleans or the king of Rome upon the throne, was the most important.

Napoleon was fully conscious of the existing state of affairs. France was down, groveling at the feet of the Allies. Here was the

engineers, with 196 guns. The Prussian forces under Blücher amounted to 120,954 men — 99,715 infantry, 11,897 cavalry and 9,360 artillery, with 312 guns. Wellington's forces, composed of Englishmen, Dutch, Belgians, Nassauers, Germans and Brunswickers, were stationed in numerous cantonments scattered over a large area around Brussels, and to the westward of the Brussels-Charleroi pike leading to the south, with the coast as their base. Of Blücher's force the First corps, under Ziethen, was at Charleroi, the Second, under Pirch, at Namur, the Third, under Thielmann, at Ciney and the Fourth, under Bulow, at Liège, with the Rhine as their base.

The movement began on 13 June. The French army advanced rapidly northward, crossed the Sambre on the afternoon of the 15th, attacked Ziethen's position, drove him back upon Fleurus, and occupied Charleroi. A portion of the army then continued the advance through Gossilies to Quatre-Bras where they met a force of 25,000 men under Wellington, on the afternoon of the 16th, and after several hours of hard fighting were driven back upon Frasnes. In the meantime, with the intention of blocking the road between Quatre-Bras and Sombreffe so as to separate the forces under Wellington and Blücher, the troops commanded by Napoleon himself attacked the Prussians at Ligny, and after three hours of severe fighting, defeated them and captured 21 guns. The battle was desperate and bloody; about 12,000 Prussians fell, and in the final charge of the Guard, Blücher himself was wounded. This was Napoleon's last victory. As the result of the battle, he assumed that the Prussians had been routed and were retreating to their base by way of Namur and Liège, when, as a matter of fact, under the direction of Gneisenau, Blücher's chief of staff, they were moving northward and converging on Wavre, with the intention of joining Wellington, with whom they were in constant communication. About noon of the 17th, Napoleon detached Grouchy with 33,000 men to pursue and complete the defeat of the Prussians driven back at Ligny, while he himself with the main body of the army joined Ney and followed Wellington, who, although victorious at Quatre-Bras, had been forced to fall back northward toward Brussels on account of the defeat of the Prussians at Ligny. Wellington's retrograde movement was continued during the whole of the 17th, until he had reached the heights of Mont Saint Jean, about four miles south of the village of Waterloo, where the Prussians could join him by way of Ohain and Wavre. Here he selected his position, and confident of their assured



Field of Waterloo. (Showing positions of the three armies at 7.30 P. M., 18 June 1815).

first time that the entire Prussian force had succeeded in concentrating at Wavre, and were now on hand to aid Wellington. He immediately detached Lobau with the Sixth corps, to intercept the new enemy, and sent a message to Grouchy, ordering him to return. Grouchy in the meantime, having moved off to Wavre in search of the Prussians, did not get this message until evening.

Lobau being unable to check the advance of the Prussians, the Young Guard was sent to re-enforce him, and then, believing that his right was secure, Napoleon massed the eight remaining battalions of the Imperial Guard for a final attack upon Wellington's centre. Supported by a terrific artillery fire, and led by Friant, the Guard advanced, while D'Erlon hurled the First corps against the British right. D'Erlon's assault was effective, but the Guard, decimated by a heavy fire from Maitland's brigade, supported by those of Halkett and Elphinstone, were repulsed with terrific loss and fell back in complete disorder before the impetuous charge of the 52d regiment. Just then, about 7.30, the main body of the Prussians arrived, and going right into action, attacked the French right and threw it into confusion. At that moment, Wellington, seeing that victory was assured, ordered a general advance of his lines and decided the contest. His troops, however, were too far gone to engage in the pursuit, which was taken up by the Prussians with vigor, and the retreat soon became a rout. Napoleon left the field in the centre of a square of the Imperial Guard. He left this at Genappe, and arrived at Charleroi at daybreak with a small escort of horsemen. He reached Paris 21 June, and signed the second abdication on the 22d. The entire campaign had lasted but three days, and the battle itself, one of the most remarkable and terrible of modern times, was decided in eight and a half hours. The French lost in killed, wounded and missing, about 31,000 men, and the Allies, about 23,000.

Bibliography.— The literature upon the subject is very extensive, but for the most reliable and exhaustive information consult Ropes, J. C., 'The Campaign of Waterloo' (New York 1892); Chesney, 'Waterloo Lectures' (London 1874), and Gardner, 'Quatre-Bras, Ligny and Waterloo' (London 1882).

WATERMAN, Nixon, American author: b. Newark, Ill., 12 Nov. 1859. He was connected with the Omaha *World-Herald* and *Bee* 1887-90; with the Chicago *Herald* and *Post* 1890-93, and since 1895 has been engaged in literary work. He is the author of 'A Book of Verses' (1900); 'In Merry Mood: a Book of Cheerful Rhymes' (1902); 'The Whistling Girl,' a comedy (1902); 'Cap and Bells' (1903); 'Io from Iowa' (1911).

WATERMELON. See MELONS.

WATERPROOFING, the art of rendering various substances impervious to the penetrating action of water. The purposes to which waterproofing is now applied are very numerous and the methods range from the early use of lead for sheathing building foundations, of tar for tarpaulin, oil for oil-skin, rubber for clothing, to various painting processes which claim for bases, substances capable of resisting the natural action of the elements, and which, invisible, impenetrable, insoluble and imperishable, effectually render brick, stone, marble, terracotta, stucco, concrete, etc., impermeable to water. These processes are used to waterproof and insulate exterior and interior walls of buildings, for cold storage plants, for the lining of reservoirs, for monuments, etc.

Among the numerous methods of waterproofing, many of which are protected by patents, the greater number in general relate to a surface application of some composition, usually somewhat thicker than an ordinary liquid solution. The more widely known methods of waterproofing are those used in connection with paper and paperboard, textile fabrics, cloth, with cordage, leather, etc.

Paper.— The commonest process for waterproofing paper and manufactures of paper is their saturation with wax or paraffine; either by the use of heat, or in solution, as with benzol. Flexible papers (and woven fabrics also) of an absorbent nature may be made waterproof by a half-and-half mixture of a vegetable oil — such as China wood oil, linseed oil, poppy seed oil or soya bean oil — with polymerized cumarone. The mixture is heated for a time, and after being allowed to cool, is dissolved in a volatile solvent, which is applied with a brush, or by dipping the material into the solution and draining off the surplus. This treatment does not affect the folding qualities of papers, practically doubles the tensile strength, and renders the sheet transparent. One of the newest methods, recently patented, consists in saturating the paper with an ammonia soap of stearic acid emulsified with paraffine and diluted with water. The paper is passed through a tank containing the emulsion, and thence is taken over a series of drying rolls to evaporate the water. A French process recently introduced consists in coating the paper with a vegetable mucilage, and, after this is dry, applying a coat of agar-agar. The paper thus prepared is then subjected to the steam arising from a bath made by adding four pounds of formol and five pounds of potassium bichromate to six quarts of water. This process renders the paper somewhat brittle, and to restore flexibility it is sponged with a weak dilution of glycerine. The so-called Japanese waterproof paper is made by pasting two sheets of paper together, the fibres crossing, with a secret waterproof cement.

Textiles.— Water-repellent textiles may be grouped into two classes according to their nature, first, the coarser tissues used for awnings, tents, oil-skins, tarpaulins or canvas coverings for exposed merchandise, etc.; secondly, the finer tissues employed for the manufacture of waterproof clothing. The processes employed are of two classes, mechanical and chemical. In the first, a solid layer of some impermeable substance is laid upon the material. The substances usually applied are india rubber, varnish, resin, pitch, tar, paints, etc. These are also impervious to air. The agents in use for chemical waterproofing are aluminum sulphate, common alum, lead acetate, copper sulphate, zinc sulphate, iron sulphate, ammonium cuprate, potassium chromate, paraffin, ceresine, wax, soap, etc. In waterproofing loosely woven fabrics it becomes necessary to fill up the interstices between the threads with imperviable

material as well as to waterproof the threads themselves. It follows that a textile which is to be waterproofed should be very tightly woven so that when the individual threads are made impervious to water the cohesion of water falling upon it will prevent its separation into particles so small as to be able to pass between the threads. The earliest process consisted in covering the tissue with tar, a method still employed for marine supplies, ropes, cordage and coverings, and which has the advantage of giving solidity to the fibre, and at the same time preserving it. Drying oils, and particularly boiled linseed oil, are still largely used to waterproof coarse tissues, and particularly for the oilskin overalls worn in rough weather by sailors and fishermen. Oiled tissues, however, are heavy and lack comfortable suppleness, while their color and appearance militate against their extended use. One of the more widely employed processes for waterproofing the coarser tissues consists in impregnating the material with an insoluble soap such as those formed with copper, iron, zinc and alumina. Copper soap is most universally used. The material to be waterproofed is first scoured by boiling with soda lye and then washed, after which it is passed through a 20 per cent ammonia soap bath, then immersed in an 8 per cent solution of sulphate of copper. According to its nature, the fibre absorbs a certain quantity, large or small, of copper soap. In the ashes produced by the burning of a square yard of canvas or linen tissue so treated, as much as 57½ grammes of copper is found, and nearly 29 grammes of copper is to be found in the cinders of the same quantity of cotton tissue. Copper-soap waterproofed materials present a characteristic greenish tint.

The manufacture of waterproofed materials for clothing has attained considerable importance. The fact, however, must be recognized that the results generally obtained are not altogether satisfactory, especially from a hygienic point of view. Absolute waterproofing cannot be obtained without wholly closing the pores of the tissue; thus prepared it is an efficacious protection from rain and from contact with water, in certain cases is of real service, but inconveniently prevents ventilation. While the garments are made watertight they are at the same time made airtight. The perspiration and natural moisture of the body are not allowed to escape, but are held in saturation in the clothing, rendering it impure, damp and uncomfortable. The body is kept damp, and upon removing the outer garments the wearer is liable to chills and colds, hence, such waterproofing is unsuitable for prolonged personal wear.

The most diverse substances can be used for waterproofing textiles, if they are soluble in a liquid other than water, and can be spread over the surface of the material,—if they possess a certain suppleness, and neither alter the fibre nor the color of the tissue. Wax, balsamic gums, isinglass, spermaceti, metallic soaps dissolved in essential oils, a solution of shellac with borax are employed in waterproofing tissues. The cloth, whether of silk, cotton, flax or wool, is usually rendered waterproof by the application of some solution of any of these substances to one or both surfaces. In many of the earlier processes, the cloth was immersed in a liquid, so as to become saturated with the waterproofing agent. An early patent was obtained for a method of rendering cloth waterproof without concealing its textile surface; the cloth in the first place is saturated with a waterproof composition; it is then dried on one side to form a hard film, while the other side is kept moist, and is afterward deprived of its composition by means of spirits of turpentine.

Frequently silk tissues are waterproofed by the use of gelatine rendered insoluble by an alumina soap. The material is impregnated by passing it through cylinders covered with swanskin, afterward being steam dried. Woolen tissues are passed through a solution of acetate of alumina obtained by treating ordinary alum with acetate of lead. The process most extensively in use at the present day is the acetate of alumina treatment. The fabric is steeped in the acetate solution for 12 hours, the temperature being kept at about 95 degrees, special care being taken that it shall not reach 100 degrees. Much difficulty in securing an even distribution of the acetate throughout the fabric is avoided by the use of the "jigger," a machine which takes the cloth on a reel and passes it continuously through a vat containing the chemical, winding it upon another reel. When it has all passed the machine reverses and rewinds the cloth on the first reel; repeating this alternation again and again. By this process the time of saturation is reduced to five hours. A still more effective method of saturation is by the vacuum process. The reel of cloth is placed in an airtight drum and the air is exhausted. The acetate liquor is then allowed to flow in, filling the cylinder. Air pressure to the extent of two and one-half to three atmospheres is applied, and allowed to remain for 45 minutes, when the operation is complete. The cloth then goes to the drying room where the temperature is kept well above 100 degrees, in order that the acetate may be changed by the heat to the insoluble basic acetate of alumina. In this condition the fabric is sufficiently waterproof for most purposes of wearing apparel. If it is required that it be absolutely waterproof, it may be made so by immersion in a 5 per cent solution of soap. An insoluble aluminum soap is formed on the fibre of the textile and adheres firmly. The fabric will now have a slippery feel, and this is quite objectionable. It is readily removed, however, by passing the goods through a solution of common alum of the strength of 1 degree or one and one-half degrees Beaumé. With some manufacturers it is a practice to add india rubber or paraffin to fortify the protection given by the insoluble aluminum soap. This is readily accomplished, as the soap solution easily forms an emulsion with melted paraffine or with a solution of rubber in a mixture of linseed and palm oils. A highly recommended formula directs that chopped-up india rubber be dissolved in twice its weight of a hot mixture of petroleum and linseed oil; and that to this be added three times its weight of Japan wax. When well mixed, a small quantity of liver of sulphur is to be worked in. This mass is then to be stirred into a boiling mixture of olein, linseed oil and resin. Finally the whole is to be saponified to a neutral soap with caustic

potash lye. The completed mixture should show a 10 per cent content of rubber and from 6 to 10 per cent of palm oil. After immersion, the fabric is calendered by polished steel rolls under heavy pressure. Linen, hemp and cotton require heavier pressure than wool or silk. In this calendering operation care is needed to avoid such extreme pressure that the textile fibres are crushed. Casein is sometimes used in waterproofing certain textiles and collodion also, but rarely.

Absolute waterproofing of textile materials is obtained by applying to their surface a thin layer of rubber. The first experiments were made in France by Besson in 1793; they were improved upon and perfected successively by Mackintosh and Hancock of Glasgow, Scotland, by Buttire and Guibal in France and by Goodyear in the United States. As in the case of Macadam with road surfaces, the successful efforts of Mackintosh perpetuated his name in connection with india rubber waterproof garments. The material is prepared by spreading on the surface a semi-liquid layer of rubber dissolved in benzol then submitting it to the action of heat to evaporate the solvent. Carbon disulphide first employed to dissolve the rubber, was replaced by a mixture of benzol or coal naphtha and essence of turpentine and later by benzol which alone is now used. In the treatment of cotton and linen cloth a small proportion of sulphur is generally added. A thin layer of this rubber solution is spread on the fabric by special machinery, after which the cloth is doubled, pressed and finished in calendars, the waterproof layer being thus in the centre of the finished material. (See Rubber Manufactures.) The offensive odor of waterproofed rubber garments may be remedied by treating them with aromatized vapors or by dipping them in concentrated infusions of vervain root, of orris root, of lavender, of camomile, etc. Ammoniacal vapor and sulphurous acid can also be successfully utilized to relieve rubbered materials of their penetrating odor. The application of rubber is made on dyed material in thread or in piece. The use of paraffine as an impervious agent allows the tissue to be dyed after being waterproofed. Paraffined tissues do not absorb water, which assumes a spheroidal shape and slides off the surface. The chief objection to paraffine lies in the fact that it is exceedingly brittle at low temperatures and melts readily with ordinary summer heat. Woolen tissues well cleaned by passing through a light and tepid bath of carbonate of soda and soap, are dried, then steeped in a solution of paraffine in petroleum ether, 60 or 100 grammes to the quart. They are afterward passed through roller pressers, dried in the open air, and sent to the dyeing vats.

As already pointed out waterproof rubbered textiles are not only impervious to water, but also to air and numerous other methods and processes have been introduced to produce fabrics which, while resisting rain, do not altogether obstruct ventilation The consecutive dipping of cloths, as already explained, in soap and alum solutions or in gelatine and gall solutions or in a solution of acetate of lead and then in a solution of alumina, are resorted to with more or less success. Algin, obtained from seaweed, has been strongly recommended for the same purpose. One of the most modern processes consists in treating the fibres in the solution before they are manufactured into textiles and the fabric thus produced, while rain-resisting, offers the same ventilation as ordinary materials. "Fibre-mail," as it is called commercially, is described as a clear, colorless substance held in solution for the purpose of treating silks, woolens, cottons, feathers, paper and other materials, so as to render them water-repellent and proof against dampness, mildew and moths. The value of the process is further stated to be by no means limited to the water-repellent qualities given to the goods treated. The application of the solution leaves a coating upon each separate fibre which, by the action of heat, is cured or vulcanized upon and into the fibre, strengthening it and leaving it impervious and elastic. Among other advantages cited are the properties of giving weight and body to the finer textile fabrics, and by this means, where desirable, economizing material, the quality of the goods being greatly improved and never deteriorated; the process also gives lustre and finish to fabrics, being especially valuable for silks, alpacas, etc.; gives elasticity and toughness to the fibres, preventing cracking and breaking qualities valuable for felt hats, silks, etc.; deepens and fastens the colors in dyed goods; resists stains and spots in the lighter and more delicate goods; prevents woods from swelling and warping; preserves painted surfaces; and prevents polished or metal surfaces from rusting.

Leather.—"Fibre-mail" is also successfully applied to leather and leather goods. Many compositions, some of them patented, have been long employed, for rendering leather waterproof by filling up the minute pores. Four or five may be briefly described as examples of the whole. Boiled linseed oil, mutton-suet, yellow-beeswax, and common resin are melted together over a slow fire and applied while hot to the leather, which is itself to be made warm. Linseed oil, resin, white vitriol, spirit of turpentine and white oak sawdust are the materials of another composition. Yellow beeswax, Burgundy pitch, turpentine and linseed oil constitute a third. A fourth plan consists in applying to the leather a hot mixture of two parts tallow with one part resin. Another is to first apply a coating of tallow to the leather with a second coating of one part copaiba balsam with two of naphtha. Caoutchouc, boiled for two hours in linseed or neat's-foot oil is also said to be effective.

Structures.—Paint and silica compounds, oils, varnishes and gums have long been experimented with for the preservation of buildings by waterproofing. The Sylvester process has long been in vogue for stone, brick and cement surfaces. It consists of alternately applying hot washes of soap and alum. Coating buildings with linseed oil has been a favorite method as affording some degree of protection against the deteriorating action of the elements. But linseed oil alone or mixed with colors, varnishes and gums has never proved wholly efficient to prevent the disintegration of stone, the weather staining of brickwork, the crumbling of mortar joints and the efflorescence of soluble salts, contained to a greater or less

degree in all bricks, cement and some varieties of stone; this is owing to the protective materials in themselves being subject both to chemical changes when exposed for a comparatively short time to the weather. When linseed oil alone is used, should there be any lime or alkaline salts in the wall, these immediately saponify the oil and render it useless as waterproofing. The oil soon dries out and leaves a spotted or mottled surface. Paint is often seen peeling off from the mortar joints of a building and from the brick work as well, owing to the same cause, the caustic alkaline properties of the salts of lime saponifying the linseed oil in the paint. Among scores of proprietary secret formulas there are some that are indisputably good and are thoroughly guaranteed by their makers. It is the custom of some architects to call for these applications in specifications.

Dry foundations are necessary in order to prevent moisture from rising by capillary attraction from the damp earth into the bases of walls or stoops. One or more perfectly waterproof courses near the foundations and reaching above the level of the ground, should be introduced as a "sine qua non" to a good building. Otherwise, a constant state of dampness, affecting that part of the structure, is apt to produce staining and disintegration beyond redemption. Cement or slate will not effectually answer this purpose owing to their absorbent qualities. Asphalt, sheet lead, copper or some other non-absorbent material should be used. The modern practice of builders of valuable structures is to construct a waterproof "membrane" completely enclosing the foundation. This is commonly a succession of layers of burlaps cemented together with asphalt and united to the foundation material by the same impervious substance. An elastic felt recently introduced is claimed to be superior to the burlaps. Sheet lead as foundation waterproofing is found in the ruins of Roman buildings 2,000 years old. One of the best processes hitherto employed for waterproofing the exterior and interior surfaces of the walls, is the paraffine compound process. The base of this compound is paraffine wax of special manufacture with refined creosote oil and other substances not disclosed. The method of application is to warm the wall to be treated, to the depth of about one-quarter of an inch, thereby evaporating all moisture and rendering it absorbent of the waxy material. The melted waterproofing is then applied to the warm surface until absorbed into the pores. It there remains for a brief time in a liquid state, penetrating as deeply as the surface is heated and dry and gradually hardens as the surface cools. The pores are thus permanently filled and rendered solid without altering the appearance of the stone, etc., treated. This waterproofing compound thus forced in by heat and becoming solid when cold, is far more durable and effective than superficial applications of cold solutions, oils or paints, applied in the usual manner, which do not penetrate into the material, which soon perish, if they are not previously chipped or rubbed off.

As a preservative of stone and marble, of monuments and statuary, vaults, etc., from the destructive effects of the weather so often observed in cemeteries, the process has proved of great value.

A material successfully used in Europe is a fluo-silicate of magnesia, commercially known as "fluate." Its application both hardens and rainproofs stone, but the effect is not instantaneous, as it takes a year to demonstrate itself. Consult Mierzinski, S., 'The Waterproofing of Fabrics.'

WATERS, wâ'tẽrz, **Clara Erskine Clement,** American writer: b. Saint Louis, Mo., 28 Aug. 1834; d. 20 Feb. 1916. She was well known as a writer and lecturer upon art. Her writings include 'Legendary and Mythological Art' (1870); 'Eleanor Maitland' (1881); 'Life of Charlotte Cushman' (1882); 'Stories of Art and Artists' (1887); 'Women Artists in Europe and America' (1903); 'Women in the Fine Arts' (1906), etc.

WATERS, Territorial. See INTERNATIONAL LAW.

WATERS, Underground. A certain amount of the water that falls on the earth's surface passes underground, the percentage varying with the porosity of the surface materials. This absorption of water is due to the fact that all rocks are somewhat porous and considerably fissured. Sand and gravel deposits are very porous and can store from 15 to 35 per cent of their bulk of water. Sandstones have space between their sand grains, but their porosity varies greatly with size of grain and especially with the amount of cementing material filling the interspaces which, in the case of quartzite and some highly calcareous sandstone, fill these spaces entirely. Most sandstones, however, are porous and many hold from 5 to 10 per cent of their bulk of water. Limestones are only slightly porous, but they are always traversed by joint planes and usually, toward the surface, by channels and caverns. Clays, shales and slates have but little capacity for water and the crystalline rocks, such as granite, have very slight porosity. Crystalline rocks, however, are usually traversed by many joint planes and often by zones of decomposition along which surface waters descend for a greater or less distance. In many districts, also, the crystalline rocks are deeply decomposed by the solution of some of their components, and the resulting "rotten rock" is usually as porous as many sandstones. Many lavas are porous and they usually are extensively fissured. Water passes underground in various ways, of which the following are the most prominent: direct inhibition of rainfall; the sinking of surface flows in passing over zones of porous rock; the spreading of streams laterally into the porous deposits of their valleys; and the percolation of water laterally from the ocean or lakes into the materials of the shore. In all regions it is found that the surface run-off and evaporation do not equal the rainfall, which is evidence of the general inhibition of water. Many streams are observed to diminish in volume and even to disappear entirely in running over areas of porous sandstones, cavernous limestones or especially permeable portions of their beds. In many arid regions waters flow out of the mountains in rocky beds and at once sink in the sands of the valleys. In nearly all river valleys there are

alluvial deposits in which the water extends laterally from the main stream and some watercourses have water only in the sands and gravels of their beds for the greater part of the year.

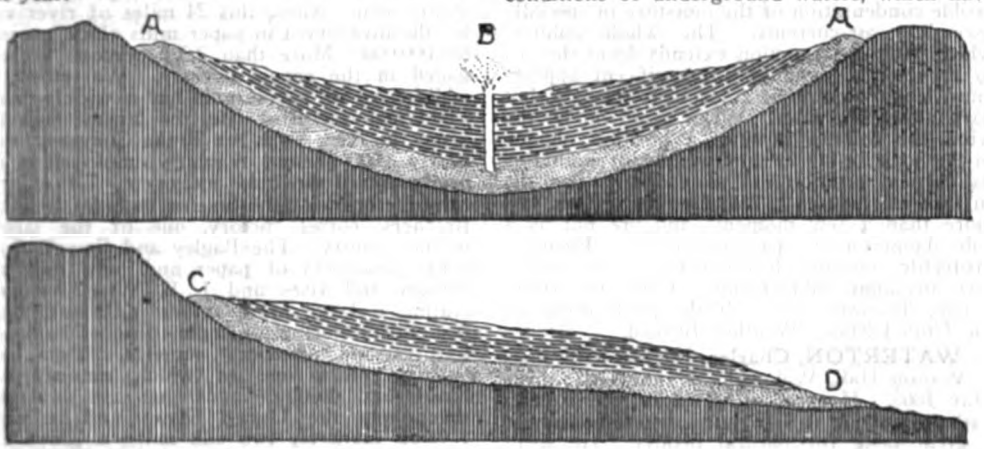


FIG. 1.

Waters present various conditions underground, in some cases flowing to lower levels, through permeable rocks, caverns in limestone or crevices in the harder rocks, to emerge as springs in hillsides, valley bottoms or even out under the ocean, as off the east coast of Florida. Usually the water supply fills an underground reservoir of sand, gravel, porous sandstone, decomposed crystalline rock or fissures. Water under this condition is usually designated "ground water" and its surface level is known as the "water plane." In some cases ground water may occupy strata or follow down crevices for a depth of several hundred feet. Waters which extend far underground are mainly contained in sandstones, and some of these water-bearers are of vast extent and often descend to great depths. Two conditions frequently existing are shown in accompanying cuts. Fig. 1. Cross-sections showing conditions of underground water in permeable rocks. In the first of these sections a bed of sandstones reaches the surface at *A A* where it receives water from rainfall or sinking of streams. This water passes underground below relatively impermeable clay or shale, and an artesian basin is formed which would yield a flowing well at *B* and at other points where the land is less elevated than at *A* and *A*. In the second section the conditions are somewhat similar, the water entering at *C* but escaping in springs at *D*, so there is a constant flow from *C* toward *D*. On account of this flow to a lower level there is gradual diminution of "head" of the water from *C* to *D*, known as the "hydraulic grade." This condition is found in the Central Great Plains of the United States, where there is a bed of porous sandstone with an average thickness of 200 feet, underlying more than 500,000 square miles and in places lying 5,000 feet deep, and apparently filled with water throughout. Many wells draw artesian supplies from this sandstone and in some areas the flows have a surface pressure of over 200 pounds to the square inch. Hundreds of billions of gallons are contained in this stratum. The rate of travel of underground water is slow, averaging about one mile a year in moderately porous sandstone.

In the accompanying figures are shown some conditions of underground waters, which have been referred to above. Fig. 2. Sections of a river valley, showing the relations of underground waters. This valley is cut in rock but partly filled with sand and gravel, as shown by

FIG. 2.

the stipple. The river flows on the surface at *A* but the waters also flow slowly underground in an "underflow" and pass laterally into the sands, filling them to the "water plane" *B B* at the level of the river. Fig. 3. Fissured and decomposed crystalline rock. Surface waters often sink deeply and occur in considerable volume under the conditions shown in this figure. *A* is the zone of decomposition and disintegration of the rock. *B B* are fissures down which the decomposition has progressed still deeper. This condition is found over wide areas in the Piedmont region of the eastern United States.

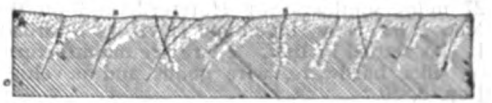


FIG. 3.

N. H. DARTON,
United States Geological Survey.

WATERSHED. See RIVERS.

WATERSPOUT, a meteorological phenomenon frequently observed at sea, and analogous to the whirlwinds experienced on land. It occurs when opposite winds of different temperatures meet in the upper atmosphere, whereby a great amount of vapor is condensed into a thick black cloud, to which a vortical motion is given. This vortical motion causes it to take the form of a vast funnel, which appears to descend near the surface of the sea, creates

public library. There are two banks. Pop. about 1,410.

WATERVLIET, wä-tėr-vlēt', N. Y., city in Albany County, on the Hudson River and on the Delaware and Hudson Railroad, opposite Troy and six miles north of Albany. Electric railways connect the city with Albany, Troy, Schenectady and Cohoes. A steel bridge over which pass electric cars for both passengers and freight spans the river at this point. It is at the head of river navigation and has by means of the Hudson River water connections with New York and intermediate points. Watervliet is a factory city having plants making woolen goods, shirtwaists, collars, bells, iron products, sashes, doors and blinds, metal harness parts, street cars, car-journal bearings, machine-shop products and boats. In 1807 the United States government established here the Watervliet Arsenal for the construction of siege ordnance and field and coast defenses; in 1919 negotiations were opened for the purchase of some 35 acres of land comprising many city blocks, the plan being to enlarge the original reservation of 109 acres with its wharfage of 1,000 feet, and to make the plant the largest of its kind in the country. The construction works have been constantly in operation and some of the largest guns in the United States' service have been made here. The place was the scene of great activity during the World War; at an expenditure of between 12 and 14 million dollars the normal output was tripled, the maximum number of employees reaching 5,125. Within the arsenal reservation are quarters for officers and barracks for soldiers. There is also a large stone magazine. The city has 12 churches representing six denominations; a high school established in 1899, Saint Patrick's Academy and public and parish schools. There is a graded school in connection with Saint Colman's Orphanage, and also with Fairview Home. Watervliet was settled about the time the first settlements were made at Albany and other places on the Hudson. It was incorporated as a village, and called West Troy in 1836. In August 1897 it was chartered as a city under its present name. Its industrial growth has been closely connected with the work of the government arsenal. It has many of the social and educational advantages of Troy and Albany. The waterworks are owned by the city, and on 10 June 1919 the commission form of government was adopted. Pop. about 18,000.

WATERWAYS OF THE UNITED STATES, The. The atlas of the world shows that three-fourths of its surface is covered with water. The waters of the earth comprise oceans, seas, straits, gulfs, bays, lakes and rivers. In the main these are navigable, but where not navigable, much has been done to make them so. In addition thereto, extensive systems of intersecting canals have been constructed, so that natural and artificial waters of the world, known as "waterways," comprise all its oceans, seas, gulfs, sounds, bays, many of its lakes and rivers, and all navigable canals.

In the United States the ebb and flow of the tide is not the test of navigability as it was in England before it was abolished by 24 Vict., ch. 10. The Supreme Court of the United States held in the Daniel Ball, 10 Wall. 557, that a different test than tidal variations must be applied here to determine navigability. The courts say that those rivers must be regarded as public navigable rivers in law, which are navigable in fact; and they are navigable in fact when they are used, or are susceptible of being used, in their ordinary condition, as highways for commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water. The commercial power of Congress authorizes such legislation as will insure the convenient and safe navigation of all navigable waters of the United States, whether that consists in requiring the removal of obstructions to their use, in prescribing the form and size of the vessels employed upon them, or in subjecting the vessels to inspection and license. The power to regulate commerce comprehends the control for that purpose and to the extent necessary, of all navigable waters of the United States which are accessible from a State other than those in which they lie. For this purpose they are the public property of the nation, and subject to all the requisite legislation of Congress. In the case of Perry *v.* Haines, 191 U. S. 17, the same court decided that admiralty jurisdiction extends to cases of maritime liens upon vessels navigating the Erie Canal, as that formed part of a navigable highway for interstate commerce between Lake Erie and the ocean. Thus artificial as well as natural navigable waters are being recognized as public waters in the sense in which Bracton used that term in the rule that *publica vero sunt omnia flumina et portus*. Years ago the English courts decided that the river Severn was a public highway, and the courts of the United States have followed the decisions of the Supreme Court of the United States heretofore stated in regard to public navigable waterways. An interior nation has a servitude along natural watercourses to reach the highway of nations, known as *jus transitus*, which is recognized by the law of nations. The right of transit over the Danube below the Iron Gates is secured by agreement. In the United States and in Canada, the rivers do not generally flow in foreign territory, so that it is not necessary to invoke the doctrine of *jus transitus*, except in a few cases, as along the Richelieu and lower Saint Lawrence.

The Atlantic Coast. *Maine.*— The waterways of Maine include 240 miles of seacoast, with many bays indenting it and scores of islands strewn along it. The Saint Croix River on the east is the outlet of Grand Lakes. It forms part of the international boundary and is navigable from its mouth up to Calais. Its tonnage in 1917 was 61,896 tons. The Penobscot is 275 miles long and navigable to Bangor by large vessels. It is the outlet of several lakes in central Maine and flows into Penobscot Bay, 30 miles long and 15 miles wide. Its tonnage in 1917 was 340,198 tons. The Kennebec is 160 miles long and navigable to Augusta. It is the outlet of Moosehead Lake, which is 36 miles long and from 8 to 12 miles wide, and navigated by pleasure steamers.

The Kennebec has a channel 150 feet wide and from 18 to 16 feet deep up to Gardiner and thence a channel 125 feet wide and 11 feet deep up to Augusta. The tonnage on that river in 1917 was 123,855 tons. The Androscoggin

River drains the famous Rangeley lakes and other lakes, and flows 200 miles into the Kennebec near its mouth. It is navigable only in part and by river craft. Sebago Lake is 12 miles long and 10 miles wide and navigable by small steamers.

Its principal seaport is Portland, but it also has other improved harbors, among which are Bar Harbor, Stockton, Camden, Rockport, Rockland, Matinicus, South Bristol, Boothbay, Sasanoa and others.

Portland has a developed waterfront of four miles in extent. It has 47 wharves, 12 of which are used for transportation terminals. Its tonnage in 1917 was 2,905,428 tons.

The tonnage of Bar Harbor in 1917 was 27,723 tons.

Saco River, 105 miles long, has a channel seven feet deep and from 100 to 200 feet in width for six miles up-stream. In 1917 its tonnage was 53,216 tons.

New Hampshire and Massachusetts.— New Hampshire has Portsmouth as its principal fortified harbor. Its rivers are few. Cochero and Exeter rivers are navigable a few miles for light draft vessels and the channel of the Merrimac has been improved to Haverhill, 16½ miles, to a depth of seven feet. Fourteen wharves extend along the Merrimac. Its tonnage in 1917 was 18,031 tons. Portsmouth and other harbors have been improved.

Pepperells Cove is a part of Portsmouth Harbor and has been improved for anchorage purposes, the controlling depth being 11 feet. Its tonnage in 1917 was 109,781 tons.

The inland lakes of New Hampshire are navigable by small pleasure boats. The same is true of the rivers of Massachusetts. It has, however, Boston Harbor, Massachusetts Bay, Cape Cod Bay, which is connected with Buzzard's Bay by a canal across Cape Cod, Nantucket Sound, Vineyard Sound, Buzzard's Bay and several other small bays, all in communication with the ocean. Boston has a land-locked harbor of 47 square miles in area. It has several improved channels from 23 to 40 feet deep and from 100 to 1,200 feet wide. Its inflowing tributaries, Chelsea Creek, Fort Point Channel, Charles River and Mystic River have all been made navigable. In 1917 the tonnage on Chelsea Creek was 532,200 tons; on Fort Point Channel 1,116,204 tons; on Mystic River 5,082,250 tons. It has four or more miles of fully-developed waterfront with wharves of various types devoted to ocean commerce. Gloucester, Beverly, Salem and Lynn harbors have all been improved. In 1917 the tonnage of Gloucester Harbor was 239,272 tons; of Beverly Harbor, 444,695 tons; of Salem, 58,158 tons and of Lynn Harbor, 338,783 tons.

Taunton River is navigable to Taunton, 15 miles from its outlet, which empties into Mount Hope Bay. The Malden, Weymouth Fore and Weymouth Back rivers are navigable at their mouths only. Salem, as a commercial port, has a reputation far more enviable than that for witchcraft.

Vermont— Vermont has part of Lake Memphremagog, which is navigable by lake steamers, and part of Lake Champlain, 120 miles long and 15 miles wide in its extreme width, which has been, since its discovery on 4 July 1609, a highway of commerce for the aborigines, for the colonists and for Americans generally. It is navigated by large lake steamers, by scores of other steamers and by many yachts and sailing vessels. It is one of the most picturesque lakes in America and forms an important portion of the 467 miles of waterway between the Saint Lawrence on the north and New York Bay on the south. It contains several beautiful islands, such as Isle La Motte, North Hero and South Hero. Lake Champlain is connected with the waters of the Hudson River at Fort Edward by the Champlain Barge Canal, having a depth of 12 feet of water, so that vessels drawing 11 feet may pass from Lake Champlain through into the Hudson River.

Whitehall, Port Henry, Burlington, Plattsburgh and Rouses Point are the principal improved ports of Lake Champlain. Its principal tributaries are the historic Otter Creek, where Commodore Macdonough built his fleet in 1814, the Missisquoi River and the Champlain or Big Chazy River. Its outlet is the Richelieu River, a tributary of the Saint Lawrence.

Rhode Island.— Rhode Island has Narragansett Bay, Mount Hope Bay, Providence and Seekonk rivers. These are navigable by large passenger and other vessels. Narragansett Bay, about 20 miles long and 12 miles wide, has channels through it to Providence and Fall River. Along its eastern margin is Sakonnet River with Portsmouth Harbor at the head of it. The Pawtucket River, 50 miles long, is improved in its lower section for a distance of five and two-tenths miles. Its tonnage in 1917 was 490,594 tons. Providence River and Harbor has been dredged to a depth of 30 feet over an area one and six-tenths miles in length and one-quarter mile in width. Its tonnage in 1917 was 3,406,224 tons. Fall River Harbor, at the mouth of Taunton River, has a channel 300 feet wide and 25 feet deep, extending out to Narragansett Bay. The steamers of the Fall River Line enter that harbor. In 1917 its tonnage was 1,469,750 tons. Newport Harbor, R. I., is an improved waterway with a channel 750 feet wide and 18 feet deep at low water. Its tonnage in 1917 was 204,701 tons.

Connecticut— Connecticut has part of Long Island Sound, the Thames River, navigable to Norwich, the Connecticut River, the Naugatuck River, navigable by small craft for a few miles and the Housatonic, 150 miles long and navigable to Shelton. It has several towns along its waterways, such as Stonington, Norwich, New London, New Haven and Bridgeport.

The tonnage of the Connecticut River below Hartford in 1917 was 602,008 tons. That river has been improved as far as Holyoke, a distance of 85.9 miles from its mouth.

There are numerous harbors along the north shore of Long Island Sound with inflowing tributaries, many of which have been improved sufficiently to be navigable by coastwise vessels.

New London has an entrance channel 600 feet wide and 33 feet deep and is well equipped with wharves and other terminal facilities. In 1917 its tonnage was 690,977 tons.

The channel at New Haven is 400 feet wide and 20 feet deep, three miles up from Long Island Sound, and it has been somewhat extended at lesser depths and widths up-stream. In 1917 the tonnage at that port was 1,868,649

tons. Thames River, Connecticut, is a tidal estuary from 400 to 4,000 feet wide, extending from Long Island Sound to Norwich, a distance of 15 miles. Its channel is 200 feet wide and from 20 feet deep to Allyn Point and 14 feet deep from there to Norwich, with wharves at New London and Norwich. The tonnage on that river in 1917 was 328,188 tons. The Housatonic River has an improved channel from 100 to 200 feet wide and seven feet deep to Derby and Shelton, a distance of 13 miles from its outlet. Its tonnage in 1917 was 300,047 tons.

Bridgeport has several improved channels from Long Island Sound leading up to the port to accommodate coastwise vessels. Its tonnage in 1917 was 1,588,056 tons.

There are several other harbors along the south coast of Connecticut that have been improved, all of which show the increasing interest in waterways improvement.

Long Island Sound is 75 miles long and 20 miles wide. It is a great waterway for several superb steamboat lines plying between New York and towns and cities on its northern shore. The Connecticut River at one time was navigated by a number of river boats and had considerable commerce. A line of boats ran between Wells River, Vt., and Hartford. The boats were flat boats and did not draw much water. The *Barnet* was the first steamer for Connecticut River service. It drew 22 inches of water. On its first trip from Hartford to Vermont it had in tow a barge filled with people. Other steamers were built for river service, in which they were engaged for many years. This river was a great natural highway for the transportation of produce to market. The rapids in the river were overcome by canals at South Hadley Falls, at Turner Falls and at Bellows Falls.

New York.—The waterways of New York comprise that portion of the Atlantic Ocean washing Long Island on the south, and that part of Long Island Sound washing Long Island on the north, and also the upper and lower New York and Jamaica bays, and a portion of Staten Island Sound and all of the East, Harlem and Hudson rivers. They also include the Mohawk, Seneca, Chemung, Black, Oswego and parts of the Delaware, Susquehanna, Genesee, Allegheny, Niagara, Saint Lawrence and other rivers, interior lakes and parts of Lakes Erie, Ontario and Champlain and others.

In and about the port of New York are many inflowing streams and contiguous harbors. Some of these are Port Chester, Mamaroneck, Echo Bay, Westchester, Bronx River, Flushing Bay, Hempstead, Huntington, Port Jefferson, Mattituck, Great South Bay, Brown's Creek, Jamaica Bay, Sheepshead Bay, East River, Wallabout Channel, Newtown Creek, Harlem River, Hudson River, New York Bay and the various improved channels therein. All such waterways have been improved and are navigable by coastwise vessels, and many of them by the ocean-going vessels.

New York is the largest commercial port in the world, having wrested first place from London recently. The total tonnage of the port of New York for the year 1917 was 65,176,983 short tons. That was during the World War, when war supplies were being shipped in great quantities. Its unique position at the confluence of the East and Hudson rivers overlooking one of the finest harbors in the world, has added to its other commercial advantages and is destined to continue it as the emporium of the western hemisphere. On the north flows the picturesque Hudson, discovered in September 1609, and navigable by steam vessels 150 miles to the city of Troy, and by canal barges to Waterford. It has been improved, its many harbors also improved and the river has been canalized from Waterford to Fort Edward. It receives on the west the waters of the Mohawk, formerly navigable about 95 miles, to Little Falls, which is also canalized from the Hudson nearly to the city of Rome. The canalized Hudson and Mohawk form a part of the improved canal system of the State of New York, constructed pursuant to the provisions of the Canal Referendum Law, which law provided for the issue and sale of the bonds of the State, amounting to $101,000,000, for the construction of a system of barge canals, having a bottom width of 75 feet and a depth of 12 feet, from the waters of the Hudson to those of Lake Champlain, Lake Ontario and Lake Erie, adequate for barges carrying 2,000 or more tons. That was followed by the Cayuga and Seneca canal referendum of 1909, authorizing a bond issue of $7,000,000 to improve the Cayuga and Seneca Canal, which was approved. That was also followed by the Barge Canal Terminal referendum measure of 1911, authorizing a further bond issue of $19,800,000 to construct Barge Canal terminals and was approved, and that was followed by the canal referendum of 1915, authorizing a further bond issue of $27,000,000, thus making aggregate bond issues for canals and terminals of $154,800,000. An additional bond issue of $25,000,000 will be required to complete the system.

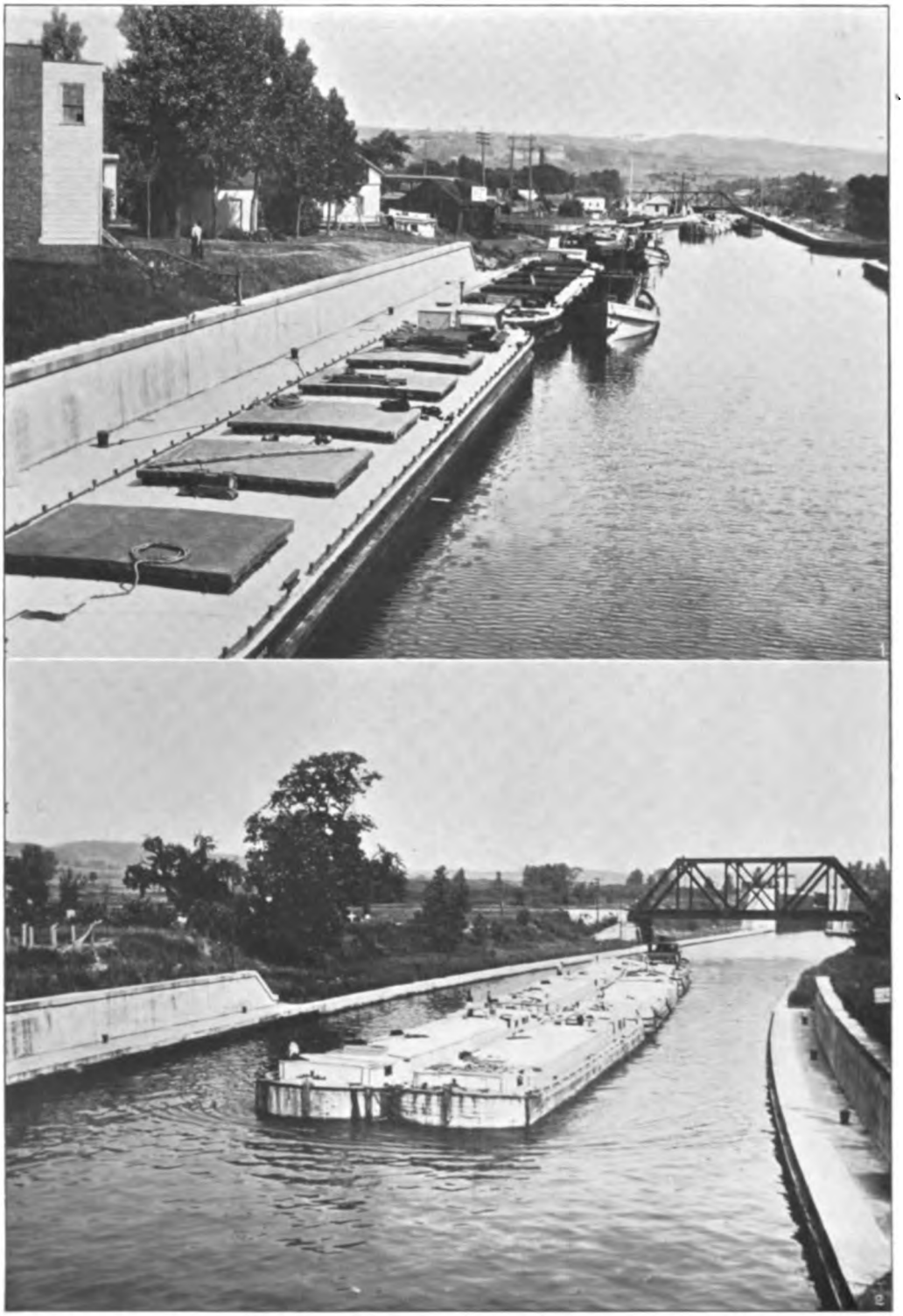
The Cayuga and Seneca Canal has been enlarged to Barge Canal dimensions and connects Cayuga and Seneca lakes with the Erie Barge Canal. The New York Barge canals have standard locks 328 feet long, 45 feet wide with 12 feet of water over mitre sills. These will admit of the passage of barges carrying 2,000 or more tons. See BARGE CANAL.

These are the largest canal improvement projects ever undertaken by one of the American States. West of the city of Rome is Oneida Lake, into which flows Wood Creek, which is canalized and connected with the Mohawk. Oneida Lake, Oneida River and Oswego River are all canalized, as well as the Seneca River from the Three River point to the outlet of Onondaga Lake, and thence southwesterly nearly to Seneca Lake. New York contains several beautiful bodies of water, such as Lake George, part of Lake Champlain, part of Lake Ontario, part of Lake Erie, Onondaga, Skaneateles, Cayuga, Seneca, Keuka, Canandaigua and Chautauqua lakes. All of these lakes are navigated by passenger steamers during the summer.

New Jersey.—The waterways of New Jersey comprise a portion of the lower Hudson, upper New York Bay, Newark Bay, Staten Island Sound, Raritan Bay, the Atlantic Ocean and several arms of the ocean indenting the eastern coast of New Jersey, and Delaware Bay on the south and the Delaware River on the west, and other rivers intersecting it.

New Jersey and Pennsylvania.—Newark Bay is navigable for six miles and Passaic

1 New York State Barge Canal lock and dam in the canalized Hudson river. Lock on the farther bank, Taintor gate regulating section of the dam in the foreground
2 Dam at the foot of Mohawk river navigation - 1,922 feet long, of gravity type, with circular trace of 700 feet radius
3 Lockport locks, where the Barge canal descends the Niagara escarpment. Two new locks have replaced one tier of five old locks



1 Steel barges built for Federal Governmental use on the New York State Barge Canal and put in service in 1919
2 Fleet of concrete barges on Barge Canal – built and used by Federal Government

River in New Jersey for 16 miles. Hackensack River has been made navigable for 15 miles from its mouth. Staten Island Sound, 17 miles long, connects New York and Raritan bays.

Commerce on Raritan Bay, Arthur Kill and Passaic River in 1906 amounted to 25,584,273 tons.

The Raritan Bay, seven miles long, and Raritan River to New Brunswick, a distance of 12 miles, are being improved. The Raritan River is navigable from Raritan Bay to New Brunswick, and from that point along the bed of the Raritan and Millstone rivers to Trenton is a canal, thus joining the waters of lower New York Bay with those of the Delaware. The total length of the Susquehanna River, including tributaries, is over 400 miles, and it is only partially navigable.

In some portions of its course the Susquehanna has been canalized to overcome rocks and vegetable matter, which obstructed its navigation. It flows into the Chesapeake Bay, which is 120 miles long and 50 miles wide. It has been improved to a depth of 15 feet with a width of 200 feet from Chesapeake Bay to Havre de Grace. It is proposed to render it navigable to Harrisburg. A bill authorizing an appropriation for this work was passed in 1919.

Pennsylvania has suffered its extensive canal system to pass from its control.

The Schuylkill River is being improved for six and one-half miles up from the Delaware River to a depth of 22 feet and 200 feet wide.

Delaware River is about 315 miles long and empties into Delaware Bay, which is 50 miles long. The river has been improved as far as Trenton, N. J., to a depth of 12 feet and to a width of 200 feet which is to be increased to 400 feet. Its channel from Delaware Bay to Philadelphia is 35 feet deep at low water and has a width of 800 feet, and in the city of Philadelphia it is 1,000 to 1,200 feet wide. The tonnage at Trenton in 1917 was 2,439,044 tons.

Philadelphia has extensive modern terminal facilities and its water-borne tonnage, coastwise and foreign, for the year 1917 was 26,282,734 short tons. The total arrival of vessels for the year was 51,206 and the departures were 58,838. This shows the enormous waterway activities of that port. Other ocean ports were more or less active.

Middle Atlantic States.—Wilmington Harbor on the Delaware River, at the mouth of Christiana River, includes sections of those two rivers and is well provided with wharves and terminals. Its tonnage in 1917 was 414,987 tons.

Several rivers, creeks and harbors in New Jersey, Delaware and Maryland have been improved. The Wilmington district includes 26 rivers, creeks and harbors that are being improved, the largest being Wilmington Harbor, including the Christiana River, navigable for 15 miles, and a tidal canal between Rehoboth and Delaware bays.

The Appoquinemink, the Smyrna, the Leipsic, Little Saint Johns, Murderkill, Mispillion and Broadkill rivers, all in Delaware, are small streams that have been improved in their lower reaches. A waterway six feet deep and 50 feet wide extends from Rehoboth Bay and Delaware Bay whose tonnage in 1917 was 15,275 tons.

The inland waterway from Delaware Bay to Chincoteague Bay, Virginia, which is six feet deep and 70 feet wide, had a tonnage in 1917 of 22,520 tons.

The Chesapeake and Delaware Canal has been purchased by the United States government and is to be enlarged and made a sea-level canal, 12 feet deep at mean low water with 90 feet bottom width. It extends from the Delaware River to Black Creek at Elk River, a distance of 18.9 miles and becomes a part of the Intercoastal Waterway from Maine to Key West.

The Baltimore district includes 26 rivers and harbors undergoing improvement. The principal harbor is Baltimore. That includes Curtis Bay and Patapsco River and tributaries and is 11 miles above Chesapeake Bay. It has several channels of 35-feet depth and of variable widths from 400 to 1,000 feet with wharves, terminal facilities and a belt line railway connecting the waterfront terminals with the trunk line railways. Its tonnage in 1917 was 14,055,885 tons.

The Washington district comprises 11 rivers and harbors, including a part of the Chesapeake Bay and the streams emptying into it.

The harbor of Washington is on the Potomac River, 110 miles from its outlet into Chesapeake Bay. The average depth of water in its channel is 20 feet.

The Washington Harbor is two miles in length and 950 feet in width. It has 44 wharves, eight of which are municipal and eight are open to the public on equal terms. Vessels of 30 feet draft may moor at the docks extending 11,000 feet along the waterfront. In 1917, the tonnage was 837,221 tons. Above Washington is the Chesapeake and Ohio Canal of six feet depth of prism paralleling the Potomac for 175 miles to Cumberland, Md.

In 1906 its tonnage was 225,142 tons. The Anacosta River is 20 miles long, flowing into the Potomac at Washington. It has been improved and has 15 terminals. Its tonnage in 1917 was 226,911 tons. Several ports have been improved on the Potomac, such as Georgetown, Alexandria and Lower Cedar Point. The Potomac River is about 400 miles long and navigable 110 miles for large vessels. It flows into Chesapeake Bay from the northwest. It receives from the south the waters of the Shenandoah. The Rappahannock River is over 200 miles long and navigable by vessels of 10-feet draft to Fredericksburg, a distance of 110 miles.

The James River is 320 miles long and is being improved to Richmond, a distance of 103.8 miles. Its channel will be 22 feet deep at mean low water and have a width of 200 to 400 feet. The river is equipped with terminals at various points connecting with railroads. It has extensive wharves and docks at Richmond, some of which are free for public use. In 1917 the tonnage was 715,255 tons.

Norfolk Harbor, Va., has a channel 40 feet deep at mean low water and 750 feet wide from Hampton Roads to the mouth of the southern branch of the Elizabeth River, and thence 450 feet wide up that branch, a distance of 11¼ miles, except in front of the navy yard where the channel is 35 feet and from 600 to 800 feet wide. There are other channels in the harbor of various dimensions. Its wharves, piers and terminals number 165. In 1917 its tonnage was 31,870,321 tons.

The harbor at Newport News, 10 miles west of Norfolk, has a channel 600 feet wide, 35 feet draft and three and one-quarter miles long. It has extensive shipbuilding, railway and other facilities. Its tonnage in 1917 was 6,259,774 tons. The lower reaches of the Appomattox, 137 miles long, a tributary of the James River, are being improved to a depth of 12 feet and with a diversion channel two and one-half miles long, and from 200 to 400 feet wide below Petersburg. Its tonnage in 1917 was 335,947 tons. The Pagan and Nansemond rivers and Cape Charles City Harbor, Va., are being improved. The Congress of the United States has made appropriations in part for the construction of an intracoastal waterway with a prism having a bottom width of 90 to 300 feet and a depth of 12 feet at mean low water, paralleling the Atlantic Coast from Norfolk, Va., to Beaufort, N. C., a distance of 186 miles. It will comprise natural watercourses except through four land cuts to connect such watercourses.

The tidal waterway along the coast of Virginia, including Cat River and Bogues Bay, with a channel four feet deep and 25 feet wide, had a tonnage in 1917 of 109,024 tons.

Four routes were surveyed for that intracoastal canal and the route via the Albemarle and Chesapeake Canal was recommended. It follows the existing waterway, via Neuse River, Adams Creek, Adams Creek Canal, Core Creek and Newport River. Several rivers which flow into the Atlantic Ocean and into the bays connected by this intracoastal canal are being improved for some distance up from their outlets and wharves and terminal facilities are being installed along their navigable waters. Roanoke River is 198 miles long, and from Weldon to its mouth, a distance of 129 miles, it is being improved to secure a channel 50 feet in width and six feet in depth. In 1917 its commerce was 78,736 tons. The Roanoke flows into Albemarle Sound, which is about 50 miles long and from five to eight miles wide, and it communicates through Croaton Sound with Pamlico Sound, which is 75 miles long and about 20 miles wide. These sounds will be connected with the Chesapeake by the intracoastal canal, having a depth of 12 feet and destined to do an active business.

The Wilmington, N. C., district comprises 25 rivers and harbors, including Beaufort Harbor, N. C., and several inland waterways and Cape Fear River. Most of the sounds are shallow and communicate with the Atlantic Ocean. Into Pamlico Sound flows the Pamlico and the River Neuse. The Cape Fear, Black and East Cape Fear rivers have been improved. Most of the other rivers and harbors of the Wilmington, N. C., district will be improved and brought into navigable communication with the coastal canal.

South Atlantic States.— The Charleston, S. C., district includes 11 rivers and harbors. The Waccamaw River is to be improved its entire length of 147 miles. The Little Peedee, South Carolina, is to be improved 113 miles above its outlet into the Great Peedee River, so as to have a four-foot channel. The Santee River is to be improved and a canal constructed between Estherville and Minim Creek, six feet deep and 70 feet wide for river steamers. Wateree River is to have a four-foot navigable channel from Camden to its mouth, a distance of 67 miles.

The Congaree River is to have a four-foot navigable channel for 49 miles above its mouth. The creeks, sounds, rivers and bays between Charleston Harbor and Alligator Creek for a distance of 47½ miles are being connected by a channel 100 feet wide and six feet deep at mean low water, and another channel seven feet deep has been recommended from Winyah Bay to Charleston, via Estherville-Minim Creek Canal. Charleston Harbor has an area of six square miles and is to be improved by the construction of a channel 30 feet deep and 500 feet wide from the sea up to the navy yard, and 1,000 feet wide out to seaward. The North Jetty is 15,443 feet long and the South Jetty is 19,104 feet long and the passageway between them is 2,900 feet wide. The eastern waterfront of Charleston Harbor has three-quarters of a mile of piers and the same length of marginal wharves. On the western front there is one small public wharf. The tonnage of the port in 1917 was 766,026 tons. The harbor is formed at the confluence of the Ashley and Cooper rivers. The Ashley River is being improved by constructing a channel 24 feet deep at mean low water and 300 feet wide from the mouth of the river up to the Standard wharf, a distance of seven and one-half miles and of eight feet depth above that to Lambs. Ashley River also has 12 phosphate wharves. Cooper River has been improved to a depth of 32 feet for six miles and a marginal wharf and warehouses have been built along it.

Savannah, Ga., district comprises 16 rivers and harbors. Savannah Harbor is being improved by a channel 30 feet deep and 500 feet wide to Quarantine, thence 26 feet deep and from 400 to 500 feet wide to the city waterworks, a distance of 16 miles, and thence 21 feet deep and 300 feet wide, one and one-half miles to King's Island, making the entire length of the improvement 27½ miles. The turning basin at West Broad and Barnard streets is 26 feet deep and 600 feet wide with a basin at Fort Oglethorp 26 feet deep and 900 feet wide. It has a wharf frontage of five miles, comprising municipal, private and railway terminals. Its tonnage in 1917 was 2,429,288 tons. From Savannah, 17 miles from the sea to Augusta, 218 miles from the sea, the Savannah River has a navigable channel of five feet depth, and along its course on many landings and at Augusta are private wharves with a total frontage of 1,450 feet. It also has a municipal wharf and warehouse with an electrically equipped elevator and locomotive crane. From Augusta to Petersburg, a distance of 53 miles, a channel is being maintained from 12 to 25 feet wide for vessels with a draft of one and three-tenths feet. A waterway 53 miles long with a depth of seven feet is being constructed along Ramshorn Creek, Wright and Mud rivers from Savannah to Beaufort, S. C. Another waterway is being constructed from Beaufort, S. C., to Saint John's River, Florida. Still another project provides for a channel seven feet deep and 150 feet wide from Savannah, Ga., to Fernandina, Fla., through Skidway and Creighton Narrows, Little Mud River, Frederica and Jekyl creeks and Cumberland River, a distance of 147 miles. Auxiliary channels through Three Mile Cut, near Darien,

around Saint Simon's and Saint Andrew's Sound and along Club and Plantation Creek with supplemental routes, altogether measuring 183 miles. These improved natural channels made navigation safer and reduced freight rates. An improved waterway, 29 miles long, seven feet deep and 100 feet wide, connects Saint John's River, Florida, six miles from its mouth, with Cumberland Sound, Georgia. Other waterways and harbors in that region are being improved.

Satilla River, Georgia, 350 miles long, is being improved so as to afford steamboat navigation 93 miles up-stream. The channel of Saint Mary's River for 12½ miles above its mouth is 17 feet deep and 200 feet wide and for 24½ miles still further up-stream the channel is being cleared.

The Altamaha River is being improved its entire length of 137 miles. It will have a channel 60 to 100 feet wide and four feet deep. Its tonnage in 1917 was 37,625 tons. The River Oconee for 145 miles and Ocmulgee for 205 miles, whose confluence forms the Altamaha, are being improved in the same manner as the last-named river. The inner and outer harbors of Brunswick, Ga., are to be dredged to a depth of 30 feet at mean low water and equipped with terminal facilities. Fernandina Harbor, Florida, and Cumberland Sound, Georgia and Florida, are also being improved.

The Jacksonville, Fla., district includes 26 rivers and harbors undergoing improvement to various navigable depths.

Saint John's River is to have a channel from 300 to 600 feet wide and a depth of 24 to 30 feet from Jacksonville to the ocean, a distance of 28 miles, and a channel 200 feet wide and 13 feet deep from Jacksonville to Palatka, a distance of 55 miles, and a channel 100 feet wide and eight feet deep from Palatka to Sanford and five feet deep from Sanford to Lake Harney, the two last improvements extending up the river 115 miles above Palatka. Lake Crescent, 14 miles long and one to three miles wide, is in touch with Saint John's River through Dunn's Creek, eight and one-half miles long, with a channel 100 feet wide and eight feet deep.

In 1917, the total number of arrivals and departure of steamers, motor boats, sail boats, lighters and rafts on the Saint John's River was 10,098. The freight traffic was 174,609 tons. A waterway, known as the East Coast Canal, extends from Saint John's River to Key West, Fla.

The channel of the Oklamaha River, Florida, a tributary of Saint John's River, is being cleared to a depth of six feet from its mouth to Silver Springs Run, a distance of 62 miles. Indian River has a channel 75 feet wide and five feet deep for 77 miles; Lucie Inlet with a channel 200 feet wide and 18 feet deep connects Indian River with the ocean, 235 miles south of Saint John's River. The Miami Harbor has an entrance channel 300 feet wide and 20 feet deep. It embraces artificial basins and dredged channels through to the ocean with parallel projecting stone jetties. It has wharves and piers, some of which are public. Its water-borne tonnage in 1917 was 244,380 tons.

The harbor at Key West has a channel 300 feet wide and 30 feet deep. The channel opposite the wharves is 26 feet deep and 800 feet wide. It is an important harbor affording shelter for vessels exposed to hurricanes. It had a tonnage in 1917 of 745,056 tons.

Gulf Coast.— The Kissimmee River is being cleared and is to have a channel 30 feet wide and three feet deep for 99½ miles, connecting several interior lakes, including Kissimmee, Tohopekaliga and Okeechobee, connected many years ago by canals with Lake Hicpochee. The lowering of the water in Lake Okeechobee for drainage purposes has interfered with the navigation of the upper Kissimmee River, which was navigable for 137 miles. The Caloosahatchee River has a channel 200 feet wide and 12 feet deep to Puntarasa and thence a channel 100 feet wide and 10 feet deep to Fort Myers, where there is a turning basin and a channel from two to four feet deep to Fort Thompson. Fort Myers is 20 miles from Charlotte Bay and Fort Thompson is 43 miles from Fort Myers. A drainage canal connects Fort Thompson through Lake Hicpochee with Lake Okeechobee. That is to be improved and made navigable so there will be a navigable channel through from Charlotte Harbor to Lake Tohopekaliga. The Orange River, a tributary of the Caloosahatchee, is also being dredged so as to have a navigable depth of four feet for a distance of six miles. Charlotte Harbor is from five to 11 miles wide and 11 miles long and is to have a channel 300 feet wide and 24 feet deep to Boca Grande, and 10 feet deep to Punta Gorda and six or seven feet in Pine Island Sound. There is now a channel 12 feet deep up Peace River to Punta Gorda, 200 feet wide in the bay and 120 feet wide in Peace River. In 1917 the tonnage was 304,095 tons.

Sarasota Bay is to be brought into navigable communication with Tampa Bay on the north by a proposed channel 100 feet wide and five feet deep. Little Sarasota Bay has a channel 75 feet wide and three feet deep to Venice. Tampa Bay is a large body of water 25 miles long to Gadsend Peninsula where it divides into Hillsboro Bay and Old Western Tampa Bay. It is from seven to ten miles wide. It has a channel from its entrance to Port Tampa 200 feet wide and 26 feet deep. Its tonnage in 1917 was 1,181,076 tons.

The connecting bays and inflowing rivers are being provided with navigable channels of 200, 300 and 500 feet in width. Hillsboro Bay and river and Manatee River are navigable for several miles. Saint Petersburg is on the west shore of Tampa Bay eight and three-quarters miles from Port Tampa. That part of the bay is called Bayboro Harbor connected by a channel 200 feet wide and 10 feet deep with the wide waters of Tampa Bay. Its tonnage in 1917 was 22,151 tons. Clearwater Harbor eight miles long and from one-half to one and three-quarters miles wide and Boca Ceiga Bay are shallow sounds but navigated by small vessels. The lower reaches of Anclote crystal, Withlocoochee and Suwannee rivers are navigable for small vessels. The latter has been improved up to Ellaville, 135 miles above its mouth, and has a channel 150 feet wide and five feet deep for the first 75 miles, and one 60 feet wide and four feet deep for the remaining 60 miles.

Alabama — The Montgomery, Ala., district includes 18 rivers and harbors Carra-

belle Harbor, Apalachicola Bay and river, the lower and upper Chipola, Flint and Chattahoochee rivers, the canal 36½ miles long connecting Apalachicola River, which is a large stream, and Saint Andrew's Bay and the entrance to Saint Joseph's Bay are all navigable waterways with channels of different widths and depths. They are being improved. Choctawhatchee Bay, 20 or more miles long, is navigable. Choctawhatchee River has a navigable channel from its mouth up to Geneva, Ala., a distance of 96 miles. Its tributary, the Holmes River, is to be made navigable from its mouth up to Vernon, a distance of 25 miles. Blackwater River will have a channel 100 feet wide and nine feet deep up to Milton, a distance of 10 miles. Escambia River, 65½ miles long in Florida, and Conecuh, 235 miles long in Alabama, is the same river and is to have a navigable channel from its mouth to Patsaliga Creek, a distance of 147 miles, unless the present project be modified.

Pensacola Harbor is 13 miles long and is five miles wide. It joins Escambia, East and Blackwater bays and Santo Rosa Sound on the southeast. Pensacola Harbor has a channel 500 feet wide from the Gulf of Mexico and 28 feet deep. It is equipped with several wharves, a terminal railway and warehouses. Its tonnage in 1917 was 524,058 tons. The Alabama River formed by the confluence of the Coosa and Tallapoosa rivers, 22½ miles above Montgomery, unites with the Tombigbee River, 44 miles above Mobile, to form the Mobile River. The Alabama, whose width is from 400 to 700 feet, and Coosa rivers are being improved so as to have a continuous channel four feet deep up to Wetumpa on the Coosa, a distance of 321.6 miles. Vessels of three feet draft may now navigate the river all the year as far as Montgomery where there are some terminal facilities and whose port tonnage in 1917 was 94,356 tons. The Coosa River, formed by the Oostanaula and Etowah rivers, is being improved by the construction of a channel 100 feet wide and four feet deep and of seven dams and seven locks 40 to 52 feet wide and 176 to 280 feet long at various points, rendering the river navigable for 165½ miles above its mouth, 22½ miles above Montgomery. Its tonnage in 1917 was 15,744 tons.

The Mobile, Ala., district includes 14 rivers and harbors. Into Mobile Harbor flows Mobile River. A channel 300 feet wide and 27 feet deep has been constructed from the ocean up Mobile Bay for 33½ miles to the river and thence up Mobile River in front of the city of Mobile for five miles to Chickasaw Creek. In the bay it is 200 feet wide and in the river 300 feet wide. Wharves and piers line the west shore of Mobile River for two and one-fourth miles. The city owns a wharf and pier in the upper end of the bay 8,300 feet long and 300 feet wide. Mobile tonnage in 1917 was 1,816,284 tons. Black Warrior River, a tributary of the Alabama River, has been dredged, and 17 dams and 18 locks have been constructed to afford slackwater navigation for 332½ miles from its mouth to Sanders Ferry on the Mulberry Fork of the Black Warrior River and to Nichols Shoals on the Locust Fork of the same river. The entire length of the section to be improved is 443½ miles to Sanders Ferry and 423½ miles to Nichols Shoals. The channel is 100 feet wide and six feet deep. The locks are 52 feet wide, about 282 feet long with a depth of six and one-half feet of water over mitre sills. The tonnage on that part of the improved waterway in use in 1917 was 580,728 tons. The Tombigbee River is shallow, having a channel two feet in depth, though in some sections it is six feet deep and all the way 100 feet wide from Demopolis to its mouth, a distance of 185 miles. In 1917 the tonnage thereon was 445,458 tons. From Demopolis, Ala., to Columbus, 149 miles, which is 230 miles from its mouth, the Tombigbee is to have a channel six feet deep by dredging and by the construction of dams and locks. From Columbus to Walkers Bridge, 169 miles, it is to have a high-water channel, which is more or less hazardous.

Mississippi and Louisiana.— Pascagoula Harbor and Gulfport Harbor have both been improved, the former having a channel 300 decreasing to 153 feet in width and a depth of 25, decreasing to 22 feet in depth four miles up Dog River. It had a tonnage in 1917 of 199,817 tons and the latter (Gulfport Harbor) has a channel 26 feet deep and 300 feet wide made through Slip Island Pass and one 19 feet deep and 1,320 feet wide for an anchorage basin one-half mile long. It had a tonnage in 1917 of 345,688 tons. Both ports have limited terminal facilities. Leaf and Chickasahay rivers have been cleared of obstructions and are navigable, the former for low water navigation 78 miles above its mouth and the latter for rafts 75 miles above the outlet. Those two rivers unite to form the Pascagoula River flowing into Mississippi Sound. That river has a channel of seven feet depth from the mouth of Dog River to Dead Lake, 32 miles, and of three feet depth above that point for 50 miles. Biloxi Harbor, Saint Louis Bay, Wolf, Jordan, East Pearl, including Lake Borgne, and Pearl rivers near the Gulf of Mexico have been dredged and are navigable for vessels of small, but different draft for limited distances. Pearl River is to have a navigable depth of two feet from its mouth to Rockport, a distance of 246 miles.

The New Orleans district includes 25 rivers, harbors and lakes. These include the South and Southwest Passes up into the Mississippi River. The latter is 1,000 feet wide between bulkheads and in the ideal area 2,400 feet wide and 35 feet deep, completed for seven miles with protecting jetties, the east one four and one-half miles and the west three and one-half miles long. Through the South Pass the channel is at least 39 feet deep between parallel dikes 700 feet apart. It is 14 miles via the South Pass from the gulf to the head of passes, 91 miles below New Orleans. The improvement of the several mouths of the Mississippi is the work of years and has involved all the skill of the Engineers of the United States army. Dikes, submerged sills with mattresses placed on the sills at the head of Pass à Loutre, through which 45.7 per cent of the waters of the river flow, and levees have been constructed at various places below New Orleans. The harbor at that city, which is about 104 miles from the Gulf, possesses the advantages of a seaport. It is from 1,500 to 3,000 feet wide

and 40 feet deep and has extensive wharves and other modern terminal facilities. It accommodates ocean-going vessels. Its domestic and foreign commerce in 1917 totaled 8,026,283 tons. Its river commerce is increasing.

Lake Pontchartrain, 40 miles long and 24 miles wide, has a central depth of 16 feet. The principal channel is seven feet deep except through the dredged channel of eight feet in depth to Lake Borgne, which is in navigable communication with Mississippi Sound. The new Basin Canal, seven miles long, brings it into communication with New Orleans. The channels of Chefuncte, which flows into the lake, and Bogue Falia, its tributary, 10½ miles above Lake Pontchartrain, are improved to Covington, a distance of 14½ miles. The tonnage of those waterways in 1917 was 288,630 tons. Pass Manchac, rising in Lake Maurepas and flowing into Lake Pontchartrain, seven miles long, is to have a channel seven feet deep and 100 feet wide and will pass vessels plying the Amite River, Bayou Manchac and Tickfaw River to and from New Orleans.

Tickfaw River flows into Lake Maurepas. It receives the Natalbany River two miles above its mouth and the Blood River seven miles above its mouth. Its channel is dredged to seven feet for 10 miles and to six feet from the 10th to the 26th mile above its mouth. Blood River is to be similarly dredged for four miles and Natalbany River and its tributary Ponchatoula, together, are improved for 15½ miles. The Amite River is to be cleared of obstructions for 110 miles above its mouth and its channel deepened and widened for 44 miles. Bayou Manchac is to be improved for 11¼ miles above its mouth. Other bayous in Louisiana are being improved. An intercoastal waterway of five feet depth and of 40 feet wide on the bottom is being constructed from Bayou Teche near Franklin to the Mermenteau River, a distance of 45 miles. It extends through several lakes and through the Hanson Canal, purchased by the United States, for a distance of 4.2 miles. A dam across Schooner Bayou and a lock are to be constructed. It also includes Schooner Bayou Canal 12 miles long, crosses White Lake 13½ miles and includes the canals, connecting Turtle, Alligator and Collicon lakes and extends to Grand Lake 12 miles wide. That waterway is navigable throughout the year. Another connecting intercoastal waterway extends from Mermenteau River, Louisiana, to Sabine River, a distance of 62 miles. It includes the Lake Misere Canal and passes south of Sweet Lake and then to Calcasieu River. It has a prism five feet deep and 40 feet wide and is to be seven feet deep and 75 feet wide from Mermenteau to Calcasieu River. It is open throughout the year. Bayou Lafourche, once one of the outlets of the Mississippi, has a lock at its head and a channel five feet deep and a bottom width of 75 feet through its entire length of 107 miles. Its tonnage in 1917 was 766,203 tons. Bayou Terrebonne is 53 miles long and empties into a bay of the same name. It has a channel six feet deep from its mouth to Houma, a distance of 24.11 miles. In 1917 its tonnage was 188,411 tons. Bayou Plaquemine is 112 miles from New Orleans via Mississippi, with which river it is connected by Plaquemine lock. Vessels passing through that lock in 1917 varied in draft from three and one-half to seven feet and the tonnage was 205,741 tons. It forms 10.6 miles of the waterway to Morgan City, La. That waterway also includes 19.4 miles of the Grand River, Bayou Natchez for six miles, Little and Big Goddel for six miles, Belle River for nine miles, Bayou Long for seven and three-tenths miles, Flat Lake and Drews Pass to Berwick Bay three and two-tenths miles and thence by Atchafalaya River three and two-tenths miles to Morgan City. Pigeon bayou connects Grand River with Grand Lake. The entire waterway is 64 miles long. The lock is 298 feet 7 inches long and 55 feet wide with 10 feet of water over the mitre sills. The tonnage over that waterway in 1917 was 776,781 tons. The boats were of four to seven feet draft. Bayou Grossetete, a tributary of the Bayou Plaquemine, is being improved from its mouth eight miles below Plauqemine lock to above Maringouin, La., a distance of 29 miles. It will have a channel five feet deep and 60 feet wide. Its tonnage in 1917 was 237,947 tons. Bayou Teche is 125 miles long and joins the Atchafalaya River 10½ miles above Morgan City. It is to have a channel six feet deep and 50 feet wide from its mouth to Arnaudville, La., a distance of 106½ miles. It is to have a dam and lock at Keystone Plantation 72½ miles above its mouth and other regulating works. In 1917 its tonnage was 693,622 tons, but that passing Keystone lock was only 10,172 tons. The Atchafalaya River, an outlet of both the Mississippi and the Red River, was provided with a channel from a point 17½ miles below Morgan City to its mouth in Atchafalaya Bay, from 1,500 to 3,000 feet in width and from 20 to 140 feet in depth. The last improvement was from the 20-foot contour four miles below its mouth to the 20-foot contour in the Gulf of Mexico, a distance of 15¾ miles to give it a ship channel 20 feet deep and 200 feet wide. The channel from Morgan City down will have a minimum depth of 14 feet and a width of 200 feet. The tonnage at Morgan City in 1917 was 814,713 tons and was carried in vessels of not exceeding 11 feet draft. Vermillion River is to have a channel five feet in depth and 40 feet on the bottom from Vermillion Bay to Lafayette, La., a distance of 51 miles. Its tonnage in 1917 was 32,810 tons. Mermenteau River is 71½ miles long and is being improved its entire length and through Lake Arthur six miles, as also are 25 miles of Bayou Nezpique, its tributary, and Mud Lake, all in Louisiana, which has a score of navigable waterways. The lower reaches of the Bayou Queue de Tortue, also a tributary of the Mermenteau, is being improved for a distance of 14 miles above its mouth. The lower section of the Bayou Plauqemine Brule, another tributary of the Mermenteau, is being improved for a distance of 19 miles so as to have a channel six feet deep and 60 feet wide. Calcasieu River widens out and forms a lake of the same name 25 miles north of the Gulf of Mexico. The lake is 18 miles long and shallow. The river, including the lake, is provided with a channel for 72 miles, which is the head of boat navigation of not less than six feet in depth. This improvement is carried through Lake Charles and West Lake, where

there are several wharves and boathouses. The mouth of the bayou is also protected by two converging jetties one and one-half miles long projecting out into the Gulf and there is a channel between them 200 feet wide and 12 feet deep up to the entrance into the river. The channel from that point to a point above Calcasieu Lake is 80 feet wide and eight feet deep. The tonnage over that waterway in 1917 was 763,619 tons.

Texas.—The Galveston, Tex., district includes 25 rivers and harbors. The entrance to Galveston Harbor is protected by two rubblestone jetties extending from Galveston Island, which is 28 miles long, and Bolivar Peninsula out into the Gulf. The former is six and three-fourths miles and the latter is four and three-fourths miles long, their outer ends being 1,000 feet apart. The channel is 30 feet deep and 800 feet wide. Galveston channel is 30 feet deep and 1,200 feet wide from the outer end more than four miles westward to 51st street in Galveston, which is to be extended, but at the reduced width of 1,000 feet to 57th street. The seawall five miles long protecting the entrance to the harbor is to be extended. The terminal facilities include a wharf system adequate to accommodate 63 or more ocean vessels, several miles of piers, grain elevators, transfer carriers and warehouses. The tonnage of the port of Galveston in 1917 was 2,965,937 tons and the number of vessels entering and departing from the port during the year was 1,539. A channel 200 feet wide and 30 feet deep and four miles long connects Galveston Harbor with Port Bolivar at the end of the Bolivar Peninsula, where there is a turning basin 1,000 feet square. The port is equipped with slips, piers, wharves and warehouses. Its tonnage in 1917 was 109,227 tons. The Houston Ship Canal, 25 feet deep and 150 feet wide on the bottom, extends from Galveston Harbor across Galveston Bay, with a bottom width, up the Jacinto River and Buffalo Bayou to a turning basin 600 feet in diameter at Long Beach and thence by a channel eight feet deep and 40 feet wide through Buffalo Bayou to Houston, Tex. The entire length of the improved waterway is 50 miles. It is protected through upper Galveston Bay by a dike nearly five miles long. There are docks, warehouses, terminals, railway tracks and other terminal facilities at Houston and a regular line of steamships between Houston and New York City. The tonnage of Houston in 1917 was 1,161,424 tons. Some other bayous and streams entering Galveston Bay have been improved for short distances under various river and harbor acts of Congress, authorizing the improvement of West Galveston Bay channel, Double Bayou and the mouths of adjacent streams. In 1851–53 the West Galveston Bay and Brazos River Canal was constructed paralleling the coast but from one to four miles therefrom. It was 10 miles long and had a depth of six feet and a width of 100 feet. It was purchased by the United States government in 1892 at a cost of $30,000. A new waterway with a channel five feet deep and 40 feet wide on the bottom is being constructed from West Galveston Bay, through Oyster Bay and along the route of the Galveston and Brazos River Canal to Brazos River. Chocolate and Bastrop bayous and Oyster Creek are commercially tributary to that waterway. The channel between Brazos River and Matagorda Bay, a distance of 32 miles, is to be five feet deep and 40 feet wide on the bottom. At the mouth of Brazos River and at Matagorda are wharves, docks and fish and oyster houses. That forms a part of the 202 miles of inland waterway extending from Galveston to Corpus Christi. The Guadalupe River is to have a channel five feet deep and 40 feet wide on the bottom for 52 miles to Victoria from San Antonio Bay, which is 16 miles across, also to be dredged to similar dimensions to the main line of the inland waterway.

The channel from Pass Cavallo to Port Lavaca, Tex., a distance of eight miles, is to have a depth of seven feet and a width of 80 feet. The channel from Pass Cavallo, the west end of Matagorda Bay, to Aransas Pass, extends through Espiritu Santo, San Antonio Mesquite and Aransas bays and is 63 miles long. It is also to have a depth of five feet and a width of 40 feet. It is equipped with wharves on Aransas Bay and at some other places. From Aransas Pass it follows Turtle Cove and passes through Corpus Christi Bay. That section of the inland waterway is 21½ miles long. Freeport Harbor is at the mouth of Brazos River and is protected by parallel north and south jetties a mile more or less in length, and is being improved for six and one-half miles to Velasco, the channel being 18 feet deep and 150 feet wide. There are some wharves there open to the public and regular sailings of vessels therefrom to New York. The tonnage of the port in 1917 was 334,693 tons.

The Brazos River is 950 miles long and is navigable to Bolivar Landing. It had a depth of four to 20 feet above that point to Old Washington, 254 miles from its mouth, and that section is to be cleared. There is but little traffic on that river. It has been proposed to improve its channel to a depth of four feet as far as Waco by the construction of locks and dams and by dredging the open channel for 103 miles. Aransas is to be protected by two rubblestone jetties, the north two and three-fourths and the south one and three-fourths miles long, and by a dike on Saint Joseph Island, three and three-fourths miles long, connecting with the north jetty.

The channel up to the town of Port Aransas is 100 feet wide and 17 feet deep, but down toward the Gulf it is 400 feet wide and 25 feet deep and still farther out it is 1,200 feet wide and 25 feet deep out between the jetties, where the dredged channel is to be 600 feet wide. The Harbor Island Basin will be thus extended. Other channels have been dredged leading from Harbor Island Basin.

The Dallas district includes 11 rivers and harbors. Port Arthur Canal, seven miles long, extends from Sabine Pass to Port Arthur docks near Taylors Bayou. Sabine Pass, seven miles in length with a width varying from 1,200 to 5,000 feet, connects Sabine Lake with the Gulf of Mexico. Its entrance is protected by jetties extending out four miles, between which is a channel 26 feet deep and 200 feet wide. The channel through Port Arthur Canal is to be 26 feet deep and 150 feet wide to Fort Arthur, where there are two turning basins 25 feet

deep, one 600 feet by 1,700 feet and the other 420 feet by 1,800 feet. At Sabine are wharves and other facilities. In 1917 the tonnage on the Port Arthur Canal was 6,984,286 tons.

That canal cost $1,029,982 and was transferred to the United States government without charge. The Sabine River, 550 miles long and 700 feet wide, enters Sabine Lake through three passes. Neches River, 300 miles long and 650 feet wide, flows into the same lake. A new waterway starting from Port Arthur Canal has a channel 25 feet deep and 90 feet wide through the land and 115 feet wide in the open lake and 150 feet wide in the open rivers and extends through the Sabine-Neches Canal and Neches River to Orange on the Sabine River and from the mouth of Neches River to Beaumont on that river, terminating in a turning basin 500 feet by 1,500 feet on each stream. There are some terminal facilities at Beaumont in touch with ocean-going vessels. The tonnage over the Sabine-Neches Canal in 1917 was 1,437,489 tons and on the Sabine River 215,605 tons and on the Neches River was 1,066,310 tons. Trinity River, Texas, 760 miles long and discharging into Galveston Bay, is being improved by the construction of dams and locks and by dredging. Thirty-seven locks and dams were recommended by the Engineers of the United States army. Those locks have chambers 140 feet long, 50 feet wide and a navigable depth of six feet over the mitre sills. In 1917 only nine locks were completed and navigation was practicable as far as Liberty, 41½ miles above the mouth of Trinity River. To completely canalize the river to Dallas Tex., 512 miles above its mouth and 370 feet above the tide water, is the present project partially completed. The city of Dallas is bearing part of the expense.

Other Gulf-State Waterways Development.—Red River is 1,275 miles long and from its mouth in Louisiana to Fulton, Ark., the distance is 482 miles. It is under improvement. From Fulton to Shreveport, La., there is a minimum depth of five feet and from Shreveport to its mouth there is a minimum depth of seven feet from December to June when the water is high and the river within its improved sections may be navigated, but not at other times. At high stages of water light draft vessels have and may still ascend as far as Denison, 763 miles above its mouth and 11 miles below the outlet of the Washita. At Denison there is in some months a depth of five feet in the channel. Lanesport, 75 miles above Fulton, formerly was at the head of navigation, though boats occasionally ascended to the mouth of the Kiamichi, 158 miles above Fulton, Ark. Some clearings of the channel and dredging has been done in the lower 51 miles of the Sulphur River, and during high water in the Red River there is a backwater flow into Sulphur River for 50 miles which render the lower reaches of the latter navigable for light draft steamboats for a distance of 17 miles for rather irregular and short periods of time. The channel of the lower part of Cypress Bayou for 66 miles is being dredged and straightened from Red River at Shreveport, La., to Jefferson, Tex. A dam has been constructed without a lock at the foot of Caddo Lake, which is 17 miles across. That dam creates a pool extending 43 miles to Jefferson City, Tex., which insures a navigable waterway four feet deep.

The Vicksburg, Miss., district comprises 16 rivers and harbors, some of which have already been described. The Ouachita River, Arkansas, is being improved by the construction of eight locks and dams and by clearing the channel so as to afford a navigable depth of six and one-half feet of water from the mouth of Black River, Louisiana, to a point 10 miles above Camden, Ark., a distance of 360 miles. The lock chambers are 55 feet wide and 268 feet long and have lifts of five and one-half to 14¼ feet. In 1917 the tonnage over that waterway was 178,136 tons. The Tensas, which has its source in Lake Providence and is 235 miles long, joins the Ouachita and Little rivers to form the Black River, Louisiana. The Tensas receives, as a tributary, Bayou Mason, which is 270 miles long. The channels of both of those streams are being cleared and improved to make the Tensas navigable from Westwood Place, 81 miles above its mouth, and Bayou Macon from Floyd, 112 miles above its mouth, so as to afford a navigable depth of six feet from January until June. At high stages those channels are 150 feet wide and eight feet deep. The traffic on the two streams in 1917 was 8,344 tons on the sections improved. Boeuf River, Bayou Bartholomew, Saline River, Bayous D'Arbonne and Coney are navigable for light draft vessels in their lower reaches during the months of high water. The Yazoo River, a tributary of the Mississippi, has a channel four feet deep and 500 feet wide its entire length of 178 miles. Loaded boats thereon draw four feet of water. The tonnage of that river in 1917 was 102,418 tons. The lower 115 miles of the Tallahatchie and the lower 40 miles of the Coldwater rivers have been made navigable for vessels of three feet draft. Big Sunflower River, a tributary of the Yazoo River, is 216 miles long and is to have a navigable depth of four and one-half feet and a navigable width of 100 feet for 171 miles above its mouth. In 1917 its tonnage was 61,017 tons. Several other smaller streams in that district have been improved.

The mouth of the Yazoo River is opened up through Lake Centennial to the Mississippi for a distance of nine and three-tenths miles with a bottom width of 98½ feet and a depth of six and one-half feet. The canal is navigable all the year. In 1917 its traffic was 61,657 tons.

The lock and dam in the Big Sunflower River at Little Callao Landing, Miss., create a pool of varying depth of one to 22 feet for 61.8 miles up stream and render the river navigable to Pentecost, Miss., 124½ miles above its mouth. The Little Rock, Ark., district comprises five rivers and the locks and dams on the upper White River. The Arkansas River, 1,460 miles long, a tributary of the Mississippi, is to be improved from its mouth to Neosho (Grand) River, 461 miles. The Grand is navigable to Fort Gibson two miles from its mouth. Under ordinary conditions from February to July the Arkansas has a navigable depth of four feet from its mouth to Little Rock, 174 miles, and some years it has a navigable depth of three feet as far as Fort Smith, 369 miles above the mouth. In 1917 steamboats ascended the river to Littles, 202 miles above its mouth, and gasolene boats ascended to Dardanelle, 261

miles above its mouth. Steamboats with barges of three to four feet draft operated as far as Little Rock for four and one-half months in 1917. The tonnage on that river in 1917 was 38,659 tons. The White River, 690 miles long, a tributary of the Mississippi, is being improved from its mouth to Batesville, a distance of 301 miles, by the construction of works, dredging, etc. A lock and dam has been constructed one mile below Batesville, a second lock and dam seven and eight-tenths miles above Batesville and a third lock and dam nine and seven-tenths miles above Batesville, thereby affording all-year slack-water navigation for vessels of three feet draft from the first dam to Guion, a distance of 33 miles farther up stream. The locks are 147 feet long, 35 feet wide, and have six feet of water over the mitre sills. At low water in 1917, its controlling channel depth was three and one-half feet from its mouth to Grand Glaize, a distance of 241 miles, and three feet from Grand Glaize to Jacksonport, a distance of 123 miles, and 14 to 16 inches from the latter port to Batesville. Forsyth, Mo., 505 miles above the mouth of the White River, was at the head of steamboat navigation. For seven and one-half months in 1917 a channel depth of six feet obtained from the mouth to Devall Bluff, a distance of 124 miles. In 1917 the tonnage on the White River was 205,198 tons and that through the three locks was 16,014 tons.

The Arkansas and White rivers enter the Mississippi River through a common inlet. The Black River in Kansas and Missouri is 300 miles long and flows into the White River at Jacksonport. It is being dredged and being made navigable from its mouth to Poplar Bluff, Mo., a distance of 239 miles, by boats of 18 inches draft and by boats of two and one-half feet to the mouth of Current River, a distance of 116 miles. In 1917 boats of three and one-half to five feet draft operated below Current River and boats of two feet draft above Current River two months. The Black River tonnage in 1917 was 154,281 tons. The Current River is 200 miles long and is being cleared of snags from its mouth to Van Buren, Mo., a distance of 94 miles, so that flatboats may ascend that far and have ascended 33 miles farther up the river to Jack's Fork. In high water steamboats ascend from the Black River as far as Pitman's Landing, 41 miles above the mouth of Current River. In 1917 the controlling channel depths were to Duff's Ferry, 32 miles above the mouth, three and one-half feet; to Doniphan, 53 miles up stream, 14 inches, and to Van Buren, from 10 to 12 inches. The tonnage in 1917 was 16,762 tons.

Some work has been done toward clearing the lower reaches of the Saint Francis River, 460 miles long, the L'Anguille River and the Blackfish Bayou to render the same navigable for boats of four-foot draft at medium and high stages of water from January until August, but the controlling depths in L'Anguille River and in Blackfish Bayou are due to the backwater stages of the Mississippi River. In 1917 a steamboat of three-foot draft operated as a weekly packet in the Helena- (on the Mississippi) Marianna- (on the Saint Francis) Blackfish commerce. The Saint Francis River to Marked Tree, the Blackfish Bayou to Fifteen Mile Bayou and the L'Anguille to Marianna are navigable by boats of four-foot draft at medium or high water. The aggregate tonnage on the three streams in 1917 was 344,278 tons.

The Mississippi System.—The Mississippi River has a total length of 2,471 miles. Its channel has a depth of 35 feet from the Head of Passes to New Orleans about 104 miles from the Gulf of Mexico and a depth of 30 feet up to a point 227 miles above the Head of Passes, which is 13 miles from the mouth of the South Pass. It has a width of 250 feet. Thence for 833 miles to the mouth of the Ohio River its channel has a depth of nine feet and a width of 250 feet and thence to Saint Louis, a distance of 188 miles, its channel has a minimum depth of eight feet and a width of 250 feet, and thence to the mouth of the Missouri, a distance of 17 miles, its channel has a depth of six feet at low water and a width of 250 feet. From the mouth of the Missouri River to the Twin City Lock and Dam, it is 664 miles and to Washington Avenue Bridge at Minneapolis, the head of navigation, it is 669 miles, that being 1,955 miles from the mouth of the Mississippi. In that section of the Mississippi River the channel is to have a depth of six feet and a width of 300 to 1,400 feet, to be obtained by means of contracting works consisting of wing and spur dams for narrowing the main channel of the river. In 1918 the depth of water at Rock Island Rapids at the lowest stages was only four feet. From Cape Girardeau, Mo., to Rock Island, Ill., a distance of 452 miles, the Mississippi for most of the way is protected by levees as it is for 1,503 miles below Cape Girardeau. The channel has been improved at various places below Cairo. At Keokuk, Iowa, 496 miles below the head of navigation and 173 miles above the outlet of the Missouri River, is a power dam of 41 feet crest with a lock 400 feet long, 110 feet wide with six feet of water over mitre sills. There is also a dry dock there 380 feet long, 140 feet wide with entrance gates 110 feet wide. During the 252 days of navigation in 1917, steamboats to the number of 489 and launches to the number of 233 passed through that lock. That replaces the old Des Moines Rapids Canal.

The Moline Lock and Dam at the foot of Rock Island Rapids, 366 miles below the head of navigation, has a length of 350 feet, a width of 80 feet and a depth of six feet of water over the mitre sills. One hundred and fifty-four steamboats, 74 barges and 270 launches passed through it during the 265 days of navigation in 1918. That lock overcomes the swiftest part of the Rock Island Rapids. Le Claire Canal has been proposed 360 miles below the head of navigation of the same dimensions as those of the Moline Canal.

Provision has been made for the construction of a power dam with a lock 350 feet long, 298 feet wide and having a lift at low water of 33½ feet between Minneapolis and Saint Paul. That will make it possible for vessels to transport grain from the elevators and flour from the mills at Minneapolis to the Gulf of Mexico or to ocean carriers without transshipment. The depth of water over the mitre sills varies from seven to 10½ feet. The upper Mississippi, from Saint Paul to Brainard, a distance of 170 miles, is navigable for light draft vessels, and from Brainard to Grand Rapids, a distance of 180

miles, it is to have a channel 60 feet wide and three and one-half feet deep at mean low water. A similar improvement has been made in the river between Aitkin and Grand Rapids, a distance of 125 miles and three and one-half feet depth has been secured. The large natural reservoirs at the head-waters of the Mississippi River, in addition to Itasca Lake, its source, and Cass Lake, 283 miles above Brainard, the head of navigation, include Winnibigoshish Lake, Leech Lake, Pokegama Lake, Sandy Lake, Pine River and Gull Lake, having an aggregate capacity of 97¼ billions cubic feet. Their discharge is regulated by dams and controlling works at their several outlets and their waters keep up a uniform flow in the Mississippi as far down as Lake Pepin, 52 miles below Saint Paul. The waters of Winnibigoshish and Leech Lakes reservoirs flow into Pokegama reservoir and thence into the Mississippi. The Leech River has been dredged and improved for 27 miles and has a channel 100 feet wide and eight feet deep and the channel of the Mississippi was made eight feet deep and 100 feet wide above the Leech River and 125 feet wide below that river, that entire section of the Mississippi improved being 65 miles in length. New Orleans has five miles of wharves, of which three and one-half miles are covered with steel sheds. Natchez has some wharves and old landings. The harbor at Memphis is subject to thick deposits and requires much dredging as do many other harbors along the Mississippi.

The Saint Croix River flowing through Lake Saint Croix, which is 25⅓ miles long, and into the Mississippi, 26.9 miles below Saint Paul, is being improved to obtain a channel three feet in depth from its mouth to Taylor's Falls, a distance of 52.3 miles.

The Minnesota River, 450 miles long, is to have an open channel to accommodate vessels of four-foot draft from its mouth at Saint Paul to Shakopee, a distance of 25.6 miles.

Lake Traverse, one of the sources of the Red River of the North, is 25 miles long and through its narrows is to have a channel 50 feet wide and four feet deep.

The Red River of the North flows northerly between Minnesota and North Dakota about 350 miles and thence along the International boundary and thence into Lake Winnipeg. From Breckenridge to Moorhead, a distance of 97 miles, it is to have a navigable channel during high and medium stages of water; from Moorhead to Grand Forks, a distance of 155 miles, it is to have a channel 50 feet wide and three feet deep, and from Grand Forks to the International Boundary, a distance of 143½ miles, it is to have a channel 60 feet wide and four feet deep at low water. Red Lake River between Thief River Falls and Red Lake, a distance of 71 miles, is to have a channel of three feet depth. Regulating works are being constructed at the outlet of that lake to control its discharge and the flow of the river in the interest of navigation. Warroad Harbor and Warroad River are southwest of the Lake of the Woods. The harbor has a wharf open to the public and the river, 26 miles long, connecting the harbor with the lake, has a depth of eight feet. In 1917 the tonnage of the harbor was 8,500 tons. A harbor of refuge has been constructed in Zippel Bay on the south shore of the Lake of the Woods.

The Missouri River from its mouth to Kansas City, a distance of 398 miles, is to have a permanent channel six feet deep and 1,200 feet wide, though in 1917 the draft of steamers was three and one-half feet and that of barges from four to four and one-half feet, but in low water it was from three to three and one-half feet. From Kansas City to Sioux City, Iowa, a distance of 409 miles, in 1917, it had a channel four feet deep, though the loaded draft of boats did not exceed two and one-half feet. From Sioux City to Fort Benton, Mont., the head of navigation, a distance of 671 miles, loaded vessels had an average draft of two feet in the upper reaches of that section of the river. The lower reaches of the Osage River from its outlet into the Missouri up to Linn Creek, a distance of 109 miles, are to have an open channel 80 feet wide and three feet deep. A lock 220 feet long and 42 feet wide with an available depth of nine feet of water over the mitre sills and with a lift of 16 feet has been constructed seven miles above its mouth. That has made the lower 109-mile section navigable for light draft vessels. In 1917 its commerce was 28,171 tons. The Gasconade River is being cleared of obstructions from its mouth to Gascondy, a distance of 61.4 miles. It had in 1917 a channel of only nine inches navigable depth in some sections and two feet in others. It had a score of small warehouses in the lower 39¼ miles of its course and a tonnage in 1917 of 24,523 tons.

The Cumberland River in Tennessee and Kentucky has been improved from Burnside, the head of navigation, to its mouth, a distance of 418.7 miles. That has been done by dredging and by the construction of locks and dams in its several sections. The average width between Burnside and Nashville, 326.1 miles below, is 300 feet and from Nashville to its outlet into the Ohio River, a distance of 192.6 miles, it has a width of 400 to 500 feet. The channel between Burnside and Nashville is 150 feet wide and six feet deep at low water. There are six locks and dams in that section of the river below Nashville. Locks A, B and C are 280 feet long by 52 feet wide, with six feet of water over the mitre sills, and have lifts of 12 feet. Locks D, E and F are 310 feet long and 52 feet wide with six and one-half feet of water over the mitre sills and have lifts of 10 to 13.3 feet. These have made the lower Cumberland navigable to Nashville and its tonnage in 1917 was 131,325 tons. In the section above Nashville, the river is navigable for light draft vessels for four or five months in the year during high water. Above Nashville are locks 1, 2, 3, 4, 5 6, 7 and 21 (locks 8 to 20 and 22 proposed in the original plans having been eliminated), each 280 feet long and 52 feet wide with six and one-half feet of water over the mitre sills and with lifts of six to 14 feet. These structures set the water back so that a navigable depth of six feet will be provided within four miles of Burnside and over that distance a navigable channel of four feet depth will be obtained. The total water-borne commerce at Nashville in 1917 was 267,091 tons. That will undoubtedly materially increase after the improvement has been completed and boat lines are established. The Board of Engineers of the United States army have recommended the construction of 10 additional locks, namely eight to 17 as originally planned, provided that the

States, counties and local agencies will save the United States harmless from claims for damages due to overflowing lands along that section of the river. The total commerce passing through all the locks in 1917 was 683,529 tons.

Tennessee.— The Tennessee, 652 miles long and formed by the junction of the French Broad and Holston rivers, four and one-half miles above Knoxville, Tenn., flows southwesterly into Alabama and westerly across the northern part of that State and thence northerly into and across Tennessee and northwesterly into and across Kentucky into the Ohio River about 36 miles above the outlet of the latter into the Mississippi. Above Chattanooga it is 700 feet wide, but below it is 1,000 feet wide and at Muscle and Colbert Shoals it is more than 1,000 feet wide. From its head to Chattanooga, a distance of 188 miles, it is to have a channel 150 feet wide and three feet deep. A concrete dam and lock 265 feet long and 60 feet wide with six and one-half feet of water over mitre sills and with a lift of 25.7 feet is at the foot of Caney Creek Shoals, which sets the water back for 24.6 miles, making a navigable depth of six feet. That 188-mile section is navigable for boats of three-feet draft, however, only when the water is at high stages from January to June. For short periods boats of four-feet draft may navigate parts of that section, but boats of only one foot draft can navigate that section all the year. Both Knoxville and Chattanooga have a wharf with a warehouse equipment with conveyors. The shoals in the upper reaches of the Tennessee are being dredged. The total river tonnage above Chattanooga for the year 1917 was 613,243 tons. Chattanooga is 464 miles above the mouth of the Tennessee. At Hale's Bar, 33 miles below Chattanooga and 431 miles above the mouth of the Tennessee, is another concrete dam and lock, 267 feet long and 60 feet wide, with six and one-half feet of water over the mitre sills and with a lift of 37½ feet. That sets the water in the river back and affords a navigable depth of six feet as far as Chattanooga. The tonnage through that lock in 1917 was 15,681 tons. Concrete dams and locks are to be constructed at Widow's Bar, 56.1 miles below Chattanooga and Bellefonte Island, 72.1 miles below Chattanooga, or one concrete dam 17.9 feet high and a lock at the latter place to provide a navigable channel of six feet depth. The locks are to be 265 feet long and 60 feet wide with six feet of water over the mitre sills. The project announced by the War Department in 1917 provides for an open channel, 150 feet wide and five feet deep at extreme low water between Hale's Bar and Brown's Island, that section being 138 miles long, except in those parts of that section that may be canalized. The Muscle Shoals Canal opened in 1890 and comprises two sections, aggregating about 18 miles in length. It had 11 locks from 275 to 283 feet in length and all 57 feet in width with different lifts, ranging from three and nine-tenths to 13.1 feet and having from two and two-tenths to seven and five-tenths feet of water over the mitre sills. The locks in the 36.6 miles of rapids above Florence overcome 134 feet of fall in the river. The existing project provides for the construction by the United States government of new locks, dams and a power-house, securing nine and one-half feet of water for 14.7 miles and a depth of five feet of water in the canals at extreme low water. The construction of dam No. 2 was approved in 1918. It is two and seven-tenths miles above Florence with locks 300 feet long, 60 feet wide and total lift of 90 feet. When the new project is completed, old locks Nos. 3 to 9, inclusive, will be submerged, but old locks Nos. 1 and 2 and locks A and B on the Elk River Shoals section will remain in service. This improvement not only provided for the navigation of the Muscle Shoals section of the Tennessee, but also for the generation of electric power for the production of some of the nitrates used during the World War. A bill is now pending in Congress for the nationalization of that nitrate plant.

From Florence, 208 miles below Chattanooga and 256.5 above the mouth of the river to Colbert Shoals, the available depth of channel at extreme low water is five feet throughout the year. In that section is the Colbert Shoals Canal on the left bank of the river and nearly eight miles long with a depth of six feet over mitre sills. Its width is 140 feet. Its single lock is 350 feet long and 80 feet wide with a lift of 26 feet. The river tonnage between Chattanooga and Florence in 1917, was 170,968 tons and through that canal was 38,286 tons.

The Tennessee from Riverton to its mouth, a distance of 226.5 miles, is to have a channel 150 feet wide and six feet deep at ordinary stages of water and at five feet deep at extreme low stages. The draft of boats in that section of the river varies from two to six feet. The tonnage below Florence in 1917 was 416,304 tons. The French Broad River has been made navigable for steamboats of two-feet draft up to Dandridge, 46½ miles above its mouth, and at stages of high water as far as Leadvale, 69½ miles above its mouth. The tonnage thereon in 1917 was 129,201 tons.

Clinch River, a tributary of the Tennessee 103½ miles above Chattanooga, is being provided with a navigable channel two feet deep from its mouth to Clinton, Tenn., a distance of 60 miles, and a channel one and one-half feet deep from Clinton to Walker's Ferry, a distance of 66 miles. The usual draft of boats varies from 15 inches to three feet, but during periods of low water there is little or no navigation of parts of the river. Its tonnage in 1917 was 8,983 tons. The United States Engineers have recommended that no further moneys be expended in its improvement. The Hiawassee River rises in northern Georgia and empties into the Tennessee, 36½ miles above Chattanooga. Its channel is being improved for 35 miles above its mouth and is to have a width of 154 feet and a depth of three feet in the centre and two and one-half feet the entire width of the channel. It has been navigated as far as Savannah Ford, though its present steamboat traffic does not extend above Charleston, Tenn., 19 miles above its mouth. Its tonnage in 1917 was 2,152 tons.

North Middle States.—The next great waterway of the United States is the Ohio River, which is formed by the junction of the Allegheny and Monongahela rivers at Pittsburgh, Pa. Thence it flows southwesterly 968½ miles into the Mississippi River at Cairo. The section between Pittsburgh and Steubenville, Ohio, a distance of 65.7 miles, has dams Nos. 1 to 10, the section from Steubenville to a point two

the construction of six locks and fixed dams in the former, a tributary of the Ohio, and one lock and dam in the latter, a tributary of the Green River. The locks are 138 to 142 feet long and 35 to 35.6 feet wide, with six to eight feet of water over the mitre sills and having lifts of 11 to 20 feet. That improvement renders the Green River navigable for boats of five-feet draft all the year from lock No. 1 at Spottsville to Mammoth Cave, Kentucky, a distance of 187½ miles, or to Bowling Green, Ky., on Barren River, a distance of 171 miles from lock No. 1 on the Green River. The tonnage in 1917 was 252,841 tons. Rough River, Kentucky, 125 miles long, another tributary of the Green River at Livermore, has been cleared of obstructions and a lock and dam have been built near Livermore, Ky. The lock is 125 feet long and 27 feet wide, with four and nine-tenths feet of water over the lower mitre sills, and having a lift of nine and four-tenths feet. That structure sets the water back and affords slack-water navigation to Hartford, Ky., 29½ miles from the mouth for boats of four-feet draft. Its tonnage in 1917 was 12,701 tons.

The Muskingum River is being improved from its outlet into the Ohio River at Marietta up to Dresden, a distance of 91 miles, by the construction of 11 locks and dams and four short lateral canals, affording a minimum depth of five and one-half feet. All the locks are 35½ feet wide and 160 feet in length with the exception of lock No. 10 which is 159 feet long, and lock No. 1 which is 55½ feet wide and 360 feet long. The depth of water over the mitre sills is six feet or more and the lifts vary from four and eight-tenths feet to 15.1 feet. There are several warehouses along the river and its tonnage in 1917 was 92,426 tons. The improvement may be extended through the valley of the Cuyahoga to form the Ohio and Erie Canal. The Big Sandy River, on the boundary between Kentucky and West Virginia, formed by the junction of the Levisa and Tug Forks, flows north 27 miles and empties into the Ohio 10 miles below Huntington. Its improvement involves the construction of three locks and dams. Two locks and dams are being constructed on each of the Levisa and Tug forks. The locks are about 158 feet long and 54½ feet wide. The improvement has rendered the Big Sandy River navigable by vessels of six-feet draft 27 miles to Levisa and the Levisa Fork navigable for 18 miles, and the Tug Fork navigable for 12 miles by vessels of six-feet draft. The tonnage on those rivers in 1917 was 88,344 tons.

Kentucky.— The Kentucky River, formed by the North, Middle and South forks, is 255 miles long and empties into the Ohio at Carrollton, Ky. It is being improved by the construction of 14 locks and fixed dams.

That affords slack-water navigation for vessels of six-feet draft to points on the three forks above Beattyville, Ky., a distance of 280 miles. The lower five locks are 145 feet long and 37 to 38 feet wide, with six and one-tenth to six and eight-tenths feet of water over the mitre sills and having lifts of 12½ to 17 feet; these afford slack-water navigation for 88 miles. The remaining nine locks are 146 feet long and 52 feet wide, with six to seven feet of water over the mitre sills, and lifts from 14.4 to 18 feet. Slack-water depth of five feet has been obtained for 260 miles up from the mouth of the river and the additional foot will be obtained as soon as the dredging is completed. In 1917 the tonnage was 148,981 tons. Some years ago, the Licking River was improved from its mouth into the Ohio 125 miles up to West Liberty.

Great Lakes System.— The Fox River, 176 miles long, in Wisconsin, is divided into the upper and lower Fox by Winnebago Lake. It has a depth of six feet from Depere to Montello, a distance of 125 miles, and a depth of four feet from Montello to Portage, a distance of 31 miles, and a width from Lake Winnebago to Montello of 100 feet. The lower Fox is from 300 to 3,000 feet wide and 39 miles long. In its course it has 27 locks and 16 dams. The locks are from 136.4 to 148.6 feet long and from 34.3 to 40 feet wide, the water over the mitre sills varies from one and two-tenths to 14 feet. The Wolf River, which flows into it 10 miles above Oshkosh, is being improved from its mouth to New London, a distance of 47 miles, to afford navigation for vessels of four-feet draft.

The head of navigation on the Upper Fox is Portage, except that during high water in the Wisconsin River, boats can proceed from Portage into Wisconsin River and thence down into the Mississippi. The tonnage on the river in 1917 was 161,060 tons. The further improvement of the Wisconsin River has been chiefly that of clearing the channel of obstructions. Formerly the Wisconsin River, a tributary of the Mississippi, 600 miles long, and the Fox River, 200 miles long, with a connecting canal, formed a continuous waterway from the Mississippi to Lake Michigan. It was declared by the courts a public highway. Grand River, Michigan, has also been declared a public highway. It has an improved channel, 100 feet wide and six feet deep, from Grand Haven, Mich., to Grand Rapids, a distance of 38 miles.

A ship canal connects Sturgeon Bay with Lake Michigan. It is 7,200 feet long, varying from 160 to 250 feet wide, and the channel is being continued into Sturgeon Bay, a distance of four miles, having a width of 200 feet and a depth of 19 feet at low water datum. In 1917 the tonnage through that canal was 720,803 tons and the harbor afforded shelter for more than 100 vessels.

The Chicago River, formed by the junction of the North and South branches, discharges into the Sanitary Canal and is only seven-tenths of a mile long. It has a channel 21 feet below low water datum in Lake Michigan. The head of navigation is Belmont avenue, five and five-fourteenths miles on the North Branch, and Ashland, four and eight-hundredths miles on the South Branch. In the Chicago River are numerous slips, docks and other terminal facilities. The Calumet River is seven and eighty-three-hundredths miles long and empties into Lake Michigan 12½ miles south of Chicago. It is formed by Little Calumet River, 60 miles long, and Grand Calumet River, which is a lagoon 18 miles long. The entrance to Calumet River is to be 200 feet wide and 21 feet deep, and the improvement is to be extended upstream five and forty-seven-hundredths miles to "The Forks," with turning basins located at intermediate points.

The river is navigable by vessels of four-feet draft from The Forks to Indiana Harbor

United States and Canadian canals are open to the vessels of either country.

The Great Lakes with their spacious bays and in-flowing tributaries are partly within the jurisdiction of the United States and partly within the Dominion of Canada. Such parts of them as are within the United States comprise some of its most important waterways. Their waters wash the shores of Minnesota, Wisconsin, Michigan, Indiana, Illinois, Ohio, Pennsylvania and New York. Other States also are brought in touch with their manifold and extensive commerce. Their score or more spacious and improved harbors with the channels of 19 to 23 feet in depth are frequented by the largest grain, ore and lumber fleets in the world, and the volume of their aggregate tonnage approaches, if it does not exceed, 100,000,000 tons annually. They are equipped with all modern appliances for loading and unloading the large lake vessels, some of whose cargo capacities exceed 14,000 gross tons. In 1917, the tonnage at the port of Duluth was 52,411,824 tons, that being the largest tonnage of any inland port in the world.

In 1917 there passed through the United States canals at Saint Mary's Falls, 10,469 lockages of vessels carrying 74,361,850 tons of freight, and 11,990 passengers, and there passed through the Canadian Saint Mary's Falls Canal 5,349 vessels carrying 15,452,048 tons of freight and 26,349 passengers, making an aggregate tonnage passing through the two Saint Mary's Falls canals of 89,813,898 tons of freight and 38,339 passengers. In addition to these were the vessels with their cargoes and passengers passing through other Great Lake ports, but not through Sault Sainte Marie canals. The lake tonnage of the port of Buffalo in 1917 was 18,925,179 tons. Such other lake ports as Superior, Chicago, Milwaukee Detroit, Toledo, Cleveland, Ashtabula, Conneaut, Erie, Tonawanda, Oswego and Ogdensburg had in the aggregate millions of tons of waterborne freights and in addition thousands of passengers. The commerce of the Great Lakes and connecting waters justifies the expenditure of millions of dollars annually to keep their harbors adequate to accommodate the several hundred lake vessels in the service. The Niagara River along its eastern margin has a ship channel 200 feet wide and 23 feet deep from Buffalo Harbor down five miles through the ship lock 650 feet long and 68 feet wide with 22 feet of water over the mitre sills into the deep waters of the river. The navigable channel at Tonawanda has been improved. Tonawanda Creek is also improved to make it navigable for lake vessels. The harbors and connecting channels of the Great Lakes are from 19 to 23 feet deep at mean lake levels.

Lake Ontario ports include Charlotte Harbor, with a channel, 200 feet wide and 20 feet deep up to the mouth of the Genesee River; Great Sodus Bay and Little Sodus Bay, which have been improved, each having an entrance channel 150 feet wide and 15½ feet deep, protected by lengthy parallel piers; Oswego Harbor with an entrance channel 16 feet deep and 600 feet wide up to the mouth of the Oswego River and Cape Vincent Harbor and the harbor at Ogdensburg. The latter is provided with an upper entrance channel 19 feet deep and from 300 to 450 feet wide, and also for a channel 19 feet deep and from 200 to 350 feet wide along the city water front, and also for a lower entrance channel and basin 19 feet deep and from 1,600 to 2,100 feet wide along the lower wharf frontage. Ogdensburg is the principal Saint Lawrence River Harbor in the United States, and its tonnage in 1917 was 1,029,427 tons. The Saint Lawrence is the outlet of the Great Lakes and flows wholly through Canadian territory below its Long Sault Rapids a few miles north of Ogdensburg.

Pacific Coast. *California.*— The Colorado River is navigable between the Laguna Dam and Fort Mohawk, a distance of 280 miles, by boats of 20 to 22 inches draft nearly all the year, provided channels be maintained through shifting bars of sand. San Diego and Los Angeles harbors have each been dredged and have entrance channels 35 feet deep and from 400 to 500 feet in width, which channels increase in width landward to turning basins. The tonnage in San Diego Harbor in 1917 was 33,092 tons, and that for 1917 in Los Angeles Harbor was 288,917 tons.

San Francisco has the largest harbor on the Pacific Coast. It is 40 miles long and from three to 10 miles wide and its depths of water vary from 40 to 90 feet. It is a landlocked harbor. It has 50 or more piers averaging 700 feet in length. Its piers for handling bulk freight are equipped with freight-handling devices. The State of California owns the entire water front of San Francisco and its terminal facilities are publicly owned and are open to the public upon reasonable terms. Its tonnage in 1917 was 9,294,366 tons. Into San Francisco Bay flows Redwood Creek which has a channel 150 feet wide and five feet deep for three and one-quarter miles up stream. Along it are several wharves. The commerce of that waterway in 1917 was 24,271 tons. Oakland Harbor is but a part of San Francisco Bay and has a channel 500 feet wide and 30 feet deep at low water through Oakland Estuary to Brooklyn Basin, a distance of four and three-quarters miles and thence it is but 300 feet wide and 25 feet deep around the basin, and 18 feet deep through Oakland Tidal Canal to San Leandro Bay, a further distance of four and three-eighths miles, making a total length of nine and one-eighth miles. Its tonnage in 1917 was 3,026,279 tons.

San Pablo Bay in California is a waterway 12 miles long and six miles wide, with a channel five miles long, 500 feet wide and 30 feet deep. It is provided with 20 privately owned wharves equipped with warehouses and other facilities. Its tonnage in 1917 was 11,531,518 tons. Suisun Channel, California, is a waterway 17 miles long with a channel 80 feet wide and six feet deep. In 1917 its tonnage was 62,842 tons. Napa River, California, is provided with a channel 75 feet wide and four feet deep, for a distance of 18 miles. It is a tidal estuary with a range of 6.92 feet at high water, giving it 11 feet of water at high tide. Steamers of five-feet draft, carrying fast freight, and sailing vessels of six-feet draft, carrying bulky freight navigate that river, whose tonnage in 1917 was 130,093 tons. Petaluma Creek, California, a stream 20 miles long emptying into San Pablo Bay, has a channel 600 feet wide

100 miles from the sea, is to have an improved channel six feet deep and 150 to 200 feet wide from Portland to Clackamas Rapids, 11½ miles, and thence a channel six feet deep and 100 feet wide to Oregon City, one and one-half miles, and thence a channel two and one-half to three and one-half feet deep to Corvallis, a distance of 106 miles. The Willamette Falls near Oregon City are overcome by a canal, four locks and a dam. The locks are 210 feet long and 40 feet wide, with six feet of water over mitre sills and having lifts of 10¼ feet. The tonnage through it in 1917 was 113,954 tons. The mouth of the Yamhill River, a tributary of the Willamette, 42 miles above Portland, was formerly the head of navigation, but loaded boats now ascend as far as Harrisburg on the Willamette, 33 miles above Corvallis. The Yamhill, eight miles above its mouth, has a lock 210 feet long and 40 feet wide, with four feet of water over the mitre sills and has a lift of 16 feet. That renders that river navigable to McMinnville, 18 miles above its mouth. Its tonnage in 1917 was 2,032 tons. Loaded boats below Oregon City are of five-feet draft and above that city they are of two-feet draft. The total traffic transported by 31 river boats in 1917 was 491,901 tons. The Lewis River, Washington, a tributary of the Columbia, 26 miles below Portland, divides three and three-quarters miles above its mouth into the North Fork, 106 miles long, and the East Fork, 36 miles long. It has a channel six feet deep and 50 feet wide to the forks. The East Fork has a channel four feet deep and 50 feet wide to La Centre, a distance of three miles, and the North Fork has a similar channel from its mouth to Woodland, a distance of three and one-half miles. Both La Centre and Woodland have terminals publicly owned. In 1917 the traffic on both forks was 25,262 tons, about one-half that of 1916.

The Cowlitz and Gray rivers, Washington, both tributaries of the Columbia River, have been improved in their lower reaches, the former as far as Toledo and the latter for eight miles above its mouth. In 1917 the tonnage on the former was 310,992 tons and on the latter 31,092 tons. Willapa Harbor is at the mouth of Willapa River, which is 30 miles long and is from 200 to 2,000 feet wide at the outlet of the harbor into the ocean. A channel 24 feet deep and 200 feet wide has been constructed from Willapa Bay to the forks of the river at Raymond, and thence up the South Fork, 150 feet wide, to the Cram lumber mill, and also from Raymond up the North Fork, 250 to 350 feet wide, to 12th street. The entire improvement extends 13½ miles. The harbor is equipped with city and railway wharves open to the public use. In 1917 its tonnage was 567,510 tons. Gray's Harbor at the mouth of the Chehalis River is 17 miles long and 14 miles wide and has a channel into it 500 feet wide and 24 feet deep, with projecting jetties, on the south three and one-half miles long and on the north three miles long. The tonnage at that port in 1917 was 455,957 tons. The Chehalis River has a channel 18 feet deep at low water and 200 feet wide from the bay to Cosmopolis, a distance of 15 miles, and thence a channel six feet deep and 150 feet wide to Montesano, a distance of eight and one-half miles. The traffic on that river in 1917 was 771,480 tons. Into Gray's Harbor also empties the Hoquiam River, whose channel is 100 feet wide and 18 feet deep for a distance of two miles. The commerce on that river is principally lumber.

Puget Sound is a large bay in the western part of the State of Washington opening out into the Strait of Juan de Fuca. It has many connecting arms and extensions, principally to the south and southwest deep waters. Into it flows the Skagit, Snohomish, Snoqualmie, Skykomish, Stilaguamish, Nooksak, Puyallup and Duwamish rivers and connecting navigable sloughs. The conditions are such that permanent results are not obtainable and continuous dredging is necessary. Large vessels may navigate the sound proper, but only vessels of six-feet draft can navigate its in-flowing streams.

At the south end of the sound is Budd Inlet. Upon this is Olympia Harbor, which has a channel 250 feet wide and 12 feet deep, with turning basins at the end of the improvement 20 feet deep. One of these is 400 feet wide and 800 feet long. The draft of vessels is limited to 10 feet. The tonnage of that port in 1917 was 283,472 tons. Another arm of Puget Sound is Commencement Bay, four miles long and two and one-half miles wide, constituting Tacoma Harbor. That has one channel 500 feet wide and 25 feet deep to 11th street bridge, and thence 18 feet deep to 14th street bridge, and thence from 500 to 200 feet wide and 15 feet deep to a point 8,500 feet from the entrance. The Puyallup waterway has a channel 500 feet wide and 28 feet deep for two-thirds of a mile. That is at the outlet of Puyallup River. The tonnage at Tacoma in 1917 was 2,912,530 tons. Lake Washington Canal extends from the lake through several bays, including Shilshole, Salmon, Lake Union and Union Bays to Puget Sound and is wholly within the city of Seattle. That canal has a double lock 760 feet long and 80 feet wide with 26 feet of water over the mitre sills and a fixed dam. Below the locks to deep water in Puget Sound, a distance of eight miles, the channel is 300 feet wide and 30 feet deep. Wharves and terminals are located on Salmon Bay, Union Bay and Lake Washington. The tonnage at Seattle in 1917 was 4,850,627 tons. Snohomish River has a channel 75 feet wide and eight feet deep for five and one-half miles above its mouth into the Puget Sound and its tonnage in 1917 was 1,038,477 tons. The channel of Skagit River, 150 miles long in the United States, is being improved nine and one-half miles above its mouth across Saratoga Passage. The draft of loaded boats is limited to three feet. Its tonnage in 1917 was 554,797 tons. Swinomish Slough, 11 miles long between Saratoga Passage and Padilla Bay, has a channel 100 feet wide and four feet deep. Its tonnage in 1917 was 54,347 tons. Bellingham Harbor, Washington, is an arm of Puget Sound. It is four miles long and two miles wide. Through its outlet is the Whatcom Creek waterway, 363 feet wide, two-thirds of a mile long and 26 feet deep at the outer end and 18 feet deep for the inner one-quarter mile of the improvement. The draft of loaded vessels was 10 feet. The tonnage of Bellingham Harbor in 1917 was 434,340 tons. The channel in Flathead Lake, Montana, is to have a channel 100

feet wide and six feet deep. Polson Bay at its southern end is a harbor six miles long and five miles wide. Loaded boats there were limited to six-feet draft.

Alaska.— Apoon Mouth is the most easterly outlet of the Yukon River and empties into Pastol Bay, 115 miles south of Nome Harbor. The Yukon is navigable for river boats of five and one-quarter-feet draft to the international boundary, a distance of 1,500 miles. Apoon Mouth has been improved for seven miles, having a channel from 150 feet wide and six feet deep through the bars at the mouth. Saint Michael Canal, Alaska, is a salt-water channel 18 miles long, 100 feet wide and six feet deep at the entrance of Saint Michael Harbor. That canal provides a sheltered passage for river boats plying between the port of Saint Michael and the mouth of the Yukon River. The tonnage thereon for the year 1910 was 24,622 tons. Nome Harbor on Norton Sound is the outlet of Snake River, a stream 20 miles long. The harbor is protected by concrete jetties 400 feet long. It has a basin 200 feet wide, 250 feet long and eight feet deep. Its tonnage in 1917 was 17,981 tons.

Hawaii and Porto Rico.— Hawaii has Honolulu Harbor, with an entrance channel 400 feet wide, 3,000 feet long and 35 feet deep at mean low water. Since the opening of the Panama Canal Honolulu has become a port of call for coal and fuel oil. It has 22 wharves and piers. Its tonnage in 1917 was 2,037,424 tons. Hawaii also has Kahului Harbor and Hilo Harbor, both improved to a depth of 35 feet. The tonnage of the former in 1917 was 228,853 tons, and that of the latter was 357,406 tons. San Juan Harbor in Porto Rico has an improved channel 600 feet wide and 30 feet deep with terminal facilities. Its tonnage in 1917 was 756,350 tons.

Cape Cod and Panama Canals.— The waterways of the United States also include many channels already described and also the Cape Cod and Panama canals. The former extends from Buzzard's Bay to Cape Cod Bay. It is from 100 to 300 feet wide on the bottom and was originally built by private parties, and may become a part of the Intercoastal Waterway from Maine to Key West. It is to be acquired by the United States and be given a prism 30 feet deep, with a minimum width of 200 feet. The largest of the government owned and operated canals is the Panama Ship Canal, approximately 40 miles long, extending from Limon Bay in the Atlantic to La Boca Bay in the Pacific. Its regulated summit level is between 82 and 87 feet above sea-level. The difference is due to the variation in the level of the Chagres River. That level is reached by a double lock, each lift being 45 feet, making a total lift of 90 feet at the Atlantic end of the canal and at the Pacific end there are double lift locks in the Pedro-Miguel section and a single lift lock below Lake Miraflores. Approximately one-half of its length is through Gatun Lake and Lake Miraflores, natural bodies of water, thereby materially reducing the original cost of that waterway. Its locks are 1,000 feet long and 110 feet wide. The canal has a minimum bottom width of 300 feet, but an average width of 649 feet, and it has a minimum depth of 41 feet.

The Waterways.— There are other waterways not mentioned in this article comprising interior lakes and unimproved rivers. The foregoing enumeration, however, of waterways and the description of their channels are sufficient to indicate their extensiveness the country over as well as their importance to the commerce of the nation. Those hereinbefore mentioned comprise thousands of miles of navigable channels. In their construction and maintenance, the government of the United States has expended hundreds of millions of dollars. Furthermore, some States and many communities have contributed large sums toward waterway improvements. The policy of co-operation between the general government and the States and communities may become a settled policy and that governmental aid may be extended only when localities advance some part of the expense of making waterway improvements. That policy has been adopted in some European countries and has been recommended by one or more commissions of the United States.

The data as to waterborne tonnage given in this article are chiefly from the official records for the year 1917. Over most waterways, it was not as voluminous as it was during the preceding four years, owing to the abnormal conditions prevailing the country over, in consequence of the Great War. Much of the commerce of the country was diverted from waterways to railways, which were under Federal control. The conditions in the year 1918 were still more unfavorable for water carriers and the waterborne tonnage, except ocean traffic, the greatest in the history of the country, was less over inland waterways than it was in 1917.

The end of the war and the return to normal industrial life will awaken an ever-increasing demand for greater facilities of transportation. The waterways of the country will furnish those facilities. The entire Atlantic, Gulf and Pacific coasts, the Great Lakes and the interior waterways of the country are equipped as shown in this article to do a volume of transportation unparalleled at any other period in the history of the world.

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States; maps and charts of various sections of the United States; reports of Municipal Harbor Improvement Commissions, and many other records.

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WATERWORKS, systems of machinery and engineering structures, employed to supply water to individual manufacturing, mining and milling plants, and to municipalities, for domestic and industrial uses and for irrigation. Such systems existed during very early periods of history, and the waterworks of ancient Greece, Carthage and Rome may be readily traced and studied by the ruins of their reservoirs and masonry aqueducts. In these earlier systems, gravity was depended upon for the delivery of the water, but force pumps were introduced about the middle of the 16th century, and extended greatly the general installation and use of waterworks systems. The waterworks built at London Bridge by Peter Maurice 1562 appear to be the first on record. The plant consisted of 16 force pumps, each 17 inches in diameter, and 30 inches long, which were driven by a current wheel, and raised 311,000 gallons of water per day to a reservoir at an elevation of 120 feet above the pumps, and from which the water was delivered by gravity, through lead pipes to buildings in the immediate vicinity.

In the United States, the first pumping plant installed to provide water for municipal purposes was that at Bethlehem, Pa., about 1760. It consisted of a five-inch wooden force pump, which raised water to a height of 70 feet through pipes of bored hemlock logs. This was replaced in 1761 by three single-acting iron pumps, each four inches in diameter, and of 18-inch stroke, operated by an undershot water-wheel. The first municipal water-supply system built in America, however, was that of Boston, in 1652. It was built by the Water-Works Company, and consisted of a reservoir about 12 feet square, to which the water from springs in the vicinity was conveyed through wooden pipes. From 1652 up to the close of the year 1800, the waterworks plants in the United States numbered 16, and had been located and built at the following named cities: Boston, Mass., 1652; Bethlehem, Pa., 1754-61; Providence, R. I., 1772; Geneva, N. Y., 1787; Plymouth, Mass., 1796; Salem, Mass., 1795; Hartford, Conn., 1797; Portsmouth, N. H., 1798; Worcester, Mass., 1798; Albany, N. Y., 1798-99; Peabody, Mass., 1799; New York City, 1799; Morristown, N. J., 1799; Lynchburg, Va., 1799; Winchester, Va., 1799-1800; and Newark, N. J., 1800. With the exception of the plants at Winchester and Morristown, they were all built by private concerns, but passed into the ownership of the respective municipalities from time to time up to 1860. The works at Winchester were built by the municipality, and those at Morristown were built by a private concern and still remain in private ownership. Up to the present time (1919) the number of plants installed throughout the country amounts to nearly 4,000, of which four-fifths are under municipal control.

A clear and concise consideration of the subject of waterworks may be facilitated by arranging the various requirements under the four general headings — quality of the water; sources of supply; modes of distribution, and public policy.

Quality expresses the fitness of the water for the special purposes for which it may be required. A good quality of water is characterized by freedom from turbidity and color, unpleasant taste and odor, and undue sewage contamination.

Taste is the first quality to be satisfied in drinking water. Even a perfectly safe water may be rejected because of nauseating flavor. This may often be remedied by dosing with chlorine and then removing the chlorine taste with sodium sulphite.

Turbidity is a condition caused by clay and silt suspended in the water. When the source of supply is a river, this condition is liable to great variation according to the amount and character of the rainfall over the watershed. Heavy rains of short duration are drained off with great erosive effect, and introduce into the flowing rivers vast quantities of finely divided inorganic matter. Such impurity, however, is more offensive than harmful, unless taken into the system frequently or in large quantities. It is removed by the use of settling reservoirs where the water is allowed to rest and deposit the heavier particles, before it is passed through the filter-beds by which the smaller particles are removed. (See WATER SUPPLY). Color is a condition more offensive to the eye than harmful to the health. The apparent color due to turbidity disappears under the processes of sedimentation and filtration, but true color, generally due to infusion of vegetable organic matter, such as leaves, grass, etc., is much more difficult to remove.

Odor is a condition which, although less frequent, is much more objectionable than turbidity or color. As a rule it is due to the life processes of minute organisms, and is removable to a considerable degree by filtration. It may, however, persist at certain times in the year and has been known to produce, or be followed by bowel disturbances among small children.

Sewage contamination is the most harmful of all the various forms of impurities natural or artificial that a water supply may be subjected to, and is the direct cause of epidemics of typhoid fever and various troubles of the intestines, which by undermining the constitution reduces its power of resistance to other diseases. The water may be somewhat purified by filtration, but the proper remedy is to remove the source of pollution. Failing this, even a much polluted water may be made reasonably safe for drinking by sterilization with chlorine.

The quality of water is ascertained by various kinds of analyses, physical, chemical and bacteriological. Physical analyses consist merely of comparisons of the given samples with standard solutions, and afford data relative to temperature, turbidity, color and odor. Chemical analyses indicate the time of past contamination and the nature of its origin — animal or vegetable, and the content of mineral salts. Bacteriological analyses are principally used to ascertain the absence or presence of the growths which cause bad taste and odor. Such analyses are capable of showing the number and probable origin of the bacteria present, but in mat-

ters of differentiation, as in the case of the typhoid germ from the harmless water bacteria, their operation is quite uncertain.

The results obtained by any set of analyses are generally interpreted by chemists and engineers by comparing them with other known facts, without attempting to establish a system of arbitrary standards. A minimum limit of impurity, however, may be stated, as follows:

(1) The best authorities consider water as unfit for drinking purposes when 100,000 parts of the liquid contain more than three parts by weight of mineral matter or one part by weight of dry organic matter, before it has been submitted to precipitation, or when it holds in suspension more than one part by weight of dry organic matter after six hours of perfect repose in a reservoir.

(2) When the same amount of liquid contains in solution more than two parts by weight of organic carbon, or three parts of nitrates.

(3) If it exhibits a distinct color under daylight when placed in a white porcelain dish, to the depth of one inch.

(4) When 100,000 parts of the liquid contain more than two parts by weight of a salt of any metal except calcium, magnesium, potassium and sodium.

(5) When 100,000 parts of the liquid contain in solution, suspension, or chemical combination, more than 0.5 part of arsenic.

(6) When 100,000 parts of the liquid, after the addition of sulphuric acid, contain more than one part by weight of free chlorine.

(7) When 100,000 parts contain more than one part by weight of sulphur in the form of sulphuretted hydrogen, or a soluble sulphuret.

(8) When 100,000 parts of the liquid holds in suspension more than 0.5 part of petroleum or hydrocarbon, or exhibits a film of the same upon its surface.

(9) When the acidity is greater than that produced by two parts by weight of hydrochloric acid to 1,000 parts of distilled water.

(10) When the alkalinity is greater than that produced by adding one part by weight of caustic soda to 1,000 parts of distilled water.

(11) When 10 cubic centimeters of water contain more than 100 harmless bacteria. This is the requirement of the government for water served on railroad trains in interstate commerce, and is adopted by all bottlers of table waters.

In general, a large percentage of chlorine and nitrates, together with the presence of *Bacillus coli communis*, an organism originating in large quantities in the human intestines, indicate sewage contamination.

A very simple but reliable test for sewage contamination was suggested by Heisch. To half a pint of the suspected water placed in a clear colorless glass-stoppered bottle, add a few grains of the best white lump-sugar, and expose the bottle freely to daylight in the window of a warm room for a week or 10 days. If the water remains clear it may be considered safe, but if it become turbid, it is open to grave suspicion of sewage contamination.

Turbidity or a precipitate which follows upon the addition of baryta water indicates the presence of carbonic acid; chloride of barium is used in the same way as a test for sulphates; nitrate of silver for chlorides; oxalate of ammonia for lime salts; sulphide of hydrogen, slightly acid, for salts of antimony, arsenic, bismuth, calcium, copper, gold, lead, mercury, platinum, silver and tin; an alkaline (by ammonia) solution of sulphide of ammonium, for salts of aluminum, chromium, cobalt, iron, manganese, nickel and zinc. Chloride of gold or mercury and the sulphate of zinc are the reagents for organic matter.

Hardness of water is a quality that bears chiefly upon its use for boilers and for laundry purposes. The hardening impurities are principally the salts of lime and magnesia. Their carbonates produce temporary hardness which may be removed by boiling, when the carbonic acid is dissipated and the insoluble bases are deposited as incrustations on the bottoms of the kettles and boilers. The carbonates are less troublesome to the human constitution than to steam users, but the sulphates, chlorides and nitrates of lime cannot be dissipated by ordinary boiling and are productive of what is known as permanent hardness. Ordinarily pure water can take up only about two grains of carbonate of lime per imperial gallon of 70,000 grains, but when carbonic acid is present, that amount of water will dissolve as much as 20 grains of the carbonate. The degree of hardness is estimated according to the number of grains of soap the solution is capable of neutralizing. Thus, one, two and three degrees of hardness represent the neutralization of 10, 20 and 30 grains of soap, respectively. The amount of waste, in the wear of clothes and soap, and the destruction of many valuable food properties by the use of hard water is not fully appreciated by the general public. It is safe to state that the money value of that waste far exceeds the cost that would supply an abundance of water for domestic purposes from a source free from impurities.

Systematic processes for softening water have been employed in the United States, principally in connection with manufacturing plants. The first process was invented by Prof. Thomas Clark, of Aberdeen, Scotland, in 1841, and consists of mixing the water supply with lime water or milk of lime, and allowing it to subside for a period ranging from 12 to 24 hours, when the water is drawn off while the precipitate is left behind. The first softening plant in connection with a municipal water supply in America is that connected with the waterworks of the city of Winnipeg, Monitoba. The source of supply is a number of artesian wells, and the water obtained is very hard. The softening process employed is a modification of that of Clark, and includes a variety of settling and filtering devices, into which the water is pumped and mixed with the lime solutions and then drawn off and distributed by direct pressure pumping into the mains. Its working provides a water more beneficial to the health, and better for domestic purposes, than that of the Red River, which formed the original water supply of the city. (See WATER SOFTENING).

While boiling is a very cheap and thoroughly effective process of purifying water, and may be used by householders in general, distillation, owing to its expense, may be employed only in special cases, in connection with artificial ice plants, the conversion of salt water into fresh water at sea, and in the various industrial arts.

It will be noted, however, that both boiled and distilled water are unpalatable unless aerated before used for drinking.

Sources of water supply will be found extensively treated under that title. In a general way, the origin of all sources is the atmosphere. It is a simple matter to trace the course of the water from the clouds in the form of rain to the rivulets which form the feeders to the lakes and rivers, and which, percolating through the porous rocks and earth, issue as sparkling springs along the valleys. Some special suggestions, however, relative to the selection of a potable water is advisable in this connection. In the open country water reaches the ground in a fairly pure condition and by selecting a site isolated from the drainage of barnyards, house sewerage and fertilized gardens, an excellent quality of water may be obtained from a well. Extending the application to where the supply is for the use of a community, town or small city, subterranean reservoirs in which the great rain percolations are stored up, may be tapped by artesian wells and furnish an inexhaustible supply of pure water. In boring these wells, however, a thorough knowledge of the geological structure of the region is important (see ARTESIAN WELLS), in order to avoid unsuccessful and costly boring operations, as well as to obtain a sufficient quantity of water free from sub-surface impurities. Waters percolating through or over the crevices of granite, gneiss, serpentine, trappean, mica-slate or silicious sandstone and drift formations, are usually quite pure, since the disintegrations of such formations are not soluble in pure water. On the other hand, limestones and chalks impart objectionable qualities. Carboniferous rocks are often composed largely of mineral salts and the water penetrating such strata are of a briny nature and are wholly unfit for domestic use. This is the case in the Kanawha Valley and in some parts of Ohio, West Virginia and the State of New York. In the bituminous limestones of the oil regions of Pennsylvania, the waters passing through those strata are saturated with petroleum compounds, while the dark waters issuing from the sulphurous rocks of the Niagara group of the Ontario geological division carry a high percentage of sulphuretted hydrogen.

As the municipality requiring the water increases in size, the quantity obtainable from a source of supply becomes more and more important. The per capita consumption varies greatly and very often quite unexplainably. See WATER SUPPLY.

In the ancient cities of Jerusalem, Rome, Byzantium and Alexandria, the consumption amounted to 300 gallons per capita, daily.

In 1870, the water consumed by the principal European cities, in gallons per capita, was as follows: London 29, Liverpool 27, Glasgow 40, Paris 30, Marseilles 40, Genoa 30, Geneva 16, Madrid 16, and Berlin 18. On the other hand, it is not an unusual thing to find American cities consuming all the way up to 300 gallons per capita, the largest consumption being in the irrigation districts and in manufacturing towns. Without doubt, a great amount of the water in such cases is really wasted, but American hydraulic engineers in planning for a water supply under the present conditions, calculate upon the basis of a consumption of 100 gallons per capita, with provisions to meet an increased demand in the near future.

A fair average daily consumption may be approximately estimated as follows, in gallons per capita, on a basis of total population: For ordinary domestic purposes, 20 gallons; for private stables, including carriage washing, 3 gallons; commercial and manufacturing purposes, 16 gallons; fountains, drinking and ornamental, 10 gallons; fire protection, 0.2 gallon; private hose and sprinkling of streets and public grounds, during the four or five driest months of the year, 10 gallons; waste to prevent the freezing of water in the service pipes and house fixtures in northern cities, during the three coldest months of the years, 10 gallons; and waste by leakage, and for flushing purposes, 10 gallons; a total of about 80 gallons. The actual domestic consumption has been proved by meters to range from eight gallons per capita in a one-family apartment with one bath and one toilet, to 46 gallons per capita in a crowded boarding house.

Thus for the larger cities, the selection of a source of supply passes from wells and springs to the large ponds and lakes. Important examples of such are found in the cities of Chicago and Milwaukee, which draw their supply from Lake Michigan, and Cleveland and Buffalo, from Lake Erie. In the majority of cases the principal cities of the world obtain their water from rivers, although a great many, as in the case of New York, which draws its supply from Croton Lake and the Esopus watershed of the Catskills, have adopted certain natural basins and converted them by artificial means, such as dams, etc., into immense reservoirs, fed solely by the rainfall over the drainage area. In such cases the principal mode of delivering the supply at the point of consumption is by gravity, through aqueducts (q.v.), connecting the source of supply with the distributing mains. Intermediate storage settling filtering reservoirs may be employed in connection with the source of supply to neutralize the conditions of turbidity, color, etc., inherent to surface waters, while auxiliary pumping stations may be built and operated in connection with standpipes if any part of the area using the water happens to be higher than the level of the source of supply. See DAMS.

On the other hand, when a river is the source of supply, its natural position in the lowest part of the valleys compels the elevating of its waters before delivery to the consumers. This is accomplished by pumping plants which raise the water into reservoirs or standpipes from which it is distributed by gravity, or it may be pumped direct into the distributing mains and thence into the service pipes. In either case, in planning a system of waterworks, it is essential that proper provisions be made to insure a pressure of delivery that is constant and adequate to supply the consumption per capita for all domestic and industrial purposes, and of sufficient power to throw fire streams over the tops of ordinary buildings. A combination of the gravity and pumping systems is employed by the city of Washington. From the Great Falls of the Potomac, situated several miles west of the city, the water is conveyed through a conduit to receiving reservoirs on the heights adjacent to the city and after a

period of subsidence, is passed into the distributing reservoirs and thence to the service mains. Certain portions in the northwestern and northeastern parts of the city being higher than the receiving reservoir, pumping stations connecting with the distributing mains pump the water into standpipes in the elevated sections, from which it is delivered to the consumers by gravity. As a rule, the cost of establishing pumping systems to lift the water from the river from a point near at hand to the standpipes, is far less than that of building the necessary aqueducts to conduct the water from a point on the river a sufficient distance beyond to insure the required head or pressure. In the case of Washington, however, the arrangement is practically necessary since the sewage of the city flows into the river in the immediate vicinity, and the current of the river itself is affected by the ebb and flow of the tide to some distance above the city, so that the water immediately at hand is in a polluted condition. In this connection it may be mentioned that but a very small number of American cities are fortunate enough to obtain an abundant supply of water directly from natural sources sufficiently transparent and limpid for domestic purposes. The great majority are compelled to resort to artificial means of various kinds, such as storage and settling reservoirs, filter beds, sterilizing basins, and pumping plants, to insure the purity and quantity required. In the light of the present knowledge of the ease with which water of a considerable degree of pollution may be sterilized with chlorine, no water-supply plant is complete without this cheap safeguard.

The character of "pumping plants" varies according to the source and mode of supply, the motive power employed and the working pressure on the pumps. In connection with the source and mode of supply, such plants are arranged for direct pumping, or for pumping into a reservoir. Direct pumping plants are liable to be affected by great and sudden changes in working pressure and, therefore, require machinery capable of responding quickly to such changes, with strong and simple working parts automatically regulated under variable speeds. On the other hand, since the machinery employed to pump into a reservoir works against an almost constant head or pressure, at a practically uniform rate of speed, a much greater latitude is presented in the economy of design and operation.

As a general rule, when the source of supply is more than 25 feet below the surface of the earth, economy in the matter of excavations and foundations compels the use of some form of a vertical rather than a horizontal pump. If the well is very deep two sets of pumps, one at the bottom and one at the surface, may be employed, or by the use of the air lift, the motive power may be kept at the surface of the ground. On the other hand, when the water has to be pumped from a river to a settling reservoir for purification, and then repumped into the distributing mains, under conditions involving a comparatively low lift, some form of horizontal or centrifugal pump is the most suitable. See PUMPS AND PUMPING MACHINERY.

Relative to motive power for the pumping plant, it is evident that water power, when it can be obtained in a sufficient amount, is the ideal source of energy, since it is generally inexhaustible and always cheap. If, however, it cannot be obtained during the whole year, it may be supplemented by steam or electric power, or by a system of storage reservoirs arranged to equalize the flow of the stream under the varying conditions of wet and dry seasons. The employment of steam, electric and compressed air power to operate pumping plants depends to a great extent upon the cost of fuel used. When the pumping plants are situated at points far from the fuel supply, they may be operated frugally, within the limits of economical electric power transmission, by power derived from dynamos driven by steam-engines or the energy of waterfalls. The high-pressure hydraulic pumps are exceptionally economical and efficient where sufficient head is available. Compressed air may be used to operate small plants located at a distance from the main plant, and also to operate air lifts where deep wells are the source of supply, while oil and gas engines are the most economical for operating isolated secondary pumping plants in large cities, or the main pumps of small towns and villages. It is a fact, however, that in a majority of the waterworks throughout the world, steam is the motive power employed, the pumping engine usually combining the motive power and pump action in one machine. They are of several different types, and the adoption of any particular one depends practically on the cost of the fuel used. When that cost is great, high duty engines, although more expensive in design and construction, but capable of performing a relatively larger amount of work with a small amount of fuel, are adopted. See PUMPS AND PUMPING MACHINERY.

For specific information on the construction of reservoirs, filter beds, tanks and standpipes see WATER SUPPLY.

Standpipes placed upon the force mains are employed by several American cities, whose reservoirs are distant from their pumping stations to equalize the resistance against the pumps. Those at Louisville, Milwaukee and Saint Louis are examples. Other cities, such as Chicago and Toledo, where proper reservoir sites are unattainable, use open-topped standpipes of considerable height, ranging from 150 to 275 feet. They serve as partial substitutes for relief valves acting in conjunction with tall air chambers. In the standpipes the surface of the water rises and falls according to the rate of delivery into them by the pumps and the rate of draft when the main over which they are place is connected with the distributing system. In northern cities they have to be housed to prevent the water from freezing during the winter.

The water obtained by any of the methods already described is supplied to the consumers by distributing systems comprising the various kinds of mains, service pipes, house fixtures, valves and hydrants which control the flow and the delivery of the water, while various kinds of meters record the amount consumed and afford a basis for taxation. See WATER METERS.

Such systems usually consist of one or more trunk mains from which numerous branch pipes, continually diminishing in size, lead under the surface of the streets and connect with the various buildings. The mains are usually of cast iron, although wooden pipes have

been and are even at the present time used under certain conditions. Under a direct pressure system, when the water is pumped through such a pipe it is called a force main. Originally they were of wrought iron, but proving unreliable were superseded by cast iron and finally by those of riveted steel. See PIPE, MANUFACTURE OF.

The size of trunk mains depends upon the required volume and velocity of the water conveyed and vary from 48 to 72 inches in diameter. Pipes leading to fire hydrants should not be less than four inches in diameter, and when of that size should be restricted to lengths not exceeding three or four hundred feet and leading to a single hydrant. Service pipes are usually of lead or wrought iron. Lead pipes, although more expensive, are preferable on account of their flexibility, smooth interior surface, great durability and relative non-corrosiveness. Plain wrought-iron and galvanized-iron pipe corrodes so rapidly that it is unfit for use unless coated both inside and outside by asphaltum or varnish of some kind. Various substances have been applied for that purpose from time to time, while interior linings of cement have been used extensively; but the present practice is confined to the application of an asphaltum bath, with perhaps the most satisfactory results obtainable. It consists simply of a mixture of coal tar and asphaltum in proportions that will give a coating non-brittle at the freezing point.

Valves are employed to control the water as it flows into the mains and from them into the service pipes. Pipes are always liable to accident through excavations for buildings, sewers, electric conduits, overflows and quicksand and clay slides. It is also very often necessary to shut off the water when new hydrants are attached, or when large pipe connections or repairs are made. Under such circumstances means to maintain a constant supply at and beyond the points involved are best obtained by a duplicate arrangement of sub-mains in parallel lines at several squares distance, joined across by a system of smaller service mains, so that there are always at least two lines of sub-mains around any given point. Under such conditions stop-valves may be used with advantage to shut off the water from a particular point without cutting off the supply from what may be a large territory lying beyond. Stop-valves are made in a great variety of forms, but the best have double self-adjusting discs, with the seats slightly divergent, so that the pressure of the screws sets the valve-discs snug upon the seats. They are usually located on the mains under some unvarying system as, on the property line of the block and five feet from the curb, on the southwest corners of street intersections. Thus they may be readily found in case of accident when hidden by a cover of frozen earth, snow, or other débris. Blow-off and waste valves are attached to pipes laid upon undulating ground, and are used to flush out the sediment deposited by the water, in the principal depressions of mains and sub-mains. Their diameters are usually about one-half that of the mains from which they branch and they may be led into sewers or wherever the waste water may be disposed of. Valves commonly known as corperation cocks regulate the flow into the houses and are usually set in the sidewalk near the curb. Check-valves act against a backward flow of water and are useful on force mains to protect the meters against back pressure, while reducing-valves are employed to relieve depressed areas of a city from excessive pressure where an effective division into high and low service is impracticable. They operate automatically, under the hydraulic pressure in the mains in which they are located, while the other forms are operated by hand or may be operated by electrical connections. Valves are expensive contrivances, and the cost of the larger sizes may be often reduced by the application of the Venturi principle, the larger pipes being gradually contracted to the size of a small valve, and then gradually increased to the original size without much loss of pressure.

Hydrants are valves used for fire-fighting and flushing purposes. In post or fire-hydrants, a vertical tube extends from the valve to a certain height above the ground. They are usually set on a branch pipe, at or near the curb line, and may be provided with from one to four nozzles, according to the capacity of the service mains, for the attachment of fire-hose. They are made in an innumerable variety of patterns; a first-class hydrant, however, consists of a frost case that is free to move up and down as the ground expands and contracts under varying temperatures, without straining the hydrant base; a waste-valve that will drain the hydrant effectually as soon as the main valve is closed, and which will close automatically as soon as the main-valve begins to open; a main-valve that is positively tight, which if it closes "with" the pressure will be free of any slack motion of its stem and thus prevent a severe water-ram at the moment it is closed; a screw motion of the valves requiring at least 10 complete revolutions before the valves are seated, thus insuring a slow closing and preventing the excessive shock and strain on the valves of an entire system that may result from a water-ram caused by the simultaneous closing of several hydrants. A stop-valve is usually placed between the main and the hydrant, so that the latter may be repaired without shutting off the flow through the mains. Hydrants should not be placed more than 500 feet apart, while in a closely built business district they may be placed at very near intervals.

Waste by leakage from the mains and poorly constructed flushing devices varies from five gallons upward per capita, and its reduction to a minimum is essential to the economical operation of any system of waterworks, but it is especially important when the service is by pumping, for the cost of pumping the waste is proportionally equal to that which is actually used. This is true also when the source of supply is distant and the purity of the water depends upon the conservation of its quantity. This can only be accomplished by careful workmanship in the construction of the plant; careful pipe laying; the use of high-grade, self-closing plumbing fixtures, especially those devices used for flushing water-closets and the installation of meters not only to detect leaks and other causes of waste in the houses, but to form the basis for charges against the consumer and compel carefulness on his part. This, however, brings the matter to a point where it is necessary to harmonize good practice with

public policy. The details of district meter systems and the inspection of service pipes are minor problems as compared with the equitable adjustment of water rates according to the various classes of consumers. In general, although the district plan is but a poor competitor of the house meter system, it has produced good results in controlling waste and detecting leaks whenever it has been employed. See HYDRAULICS; HYDROSTATICS.

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WATIE, Stand, Cherokee Indian leader and soldier: b. Oo-yoo-ge-lo-gi, near the present town of Rome, Ga., about 1806; d. 2 Sept. 1871. His father, Oo-wa-tie, was a Cherokee of pure Indian blood and his mother was the child of a white father and a Cherokee mother. His given name was Degataga, which, rendered into English, signified "standing together," whence came his English given name, Stand. His surname was a contraction of his father's given name. Elias Boudinot, known also as Buck Watie, was an elder brother of Stand Watie. Major Ridge was his uncle. In common with his immediate kinsmen, Stand Watie was active in his support of the removal treaty and was marked for assassination at the same time they were but was warned in time to save himself. He was thenceforth regarded as the head of the Ridge, or Treaty Party in the Cherokee Nation. At the outbreak of the Civil War, he espoused the cause of the seceding States, raised a regiment for the Confederate service, commanding it with the rank of colonel until May 1864, when he was promoted to the grade of brigadier-general. The end of the war found him homeless and penniless. His brave struggle with adversity was ended by his death.

WATKIN, wŏt'kĭn, **Sir Edward William,** English railway manager: b. Northenden, Cheshire, 1819; d. London, 14 April 1901. He was engaged in the warehouse of his father, a London merchant, from 1829-45 when he became secretary to the Trent Valley Railroad Company, and thenceforward continued in the railway business, becoming general manager and director in various leading companies. He was chairman of the Southeastern in 1867 and of the Metropolitan in 1872, extricating each from financial difficulties. While president of the Canadian Grand Trunk he prosecuted negotiations which resulted in the confederation of the five British North American provinces. He was elected to Parliament for Great Yarmouth in 1857, but was unseated by petition. In 1864-68 he was a member for Stockport and for Hythe in 1874-95. He was knighted in 1868, and created a baronet in 1880. He was the chief promoter of the Channel tunnel project.

WATKINS, wŏt'kĭnz, **John Elfreth,** American scientist: b. Ben Lomond, Va., 17 May 1852; d. 1903. He was graduated from Lafayette College in 1871, and until 1872 was mining engineer for the Delaware and Hudson Canal Company. He was appointed curator of the United States National Museum in 1877, an office he occupied until 1892, and in 1895 became superintendent and curator of its technological collections. He wrote much concerning the development of railroad and telegraph systems, including 'The Evolution of the Railway Passenger Car' (1888); 'History of the Pennsylvania Railroad, 1846-96' (1896), etc.

WATKINS, N. Y., village, county-seat of Schuyler County, on Seneca Lake, and on the New York Central and Hudson River (Fall Brook) and the North Central railroads, about 20 miles north of Elmira. It is in an agricultural region in which are large vineyards. The Glen Springs Sanitarium is a famous salt plant, but the chief attraction is the glen. The principal manufactories are flour and lumber mills, wagon and carriage factories and iron foundries. Several mineral springs are nearby. Large quantities of grapes are shipped in the season. The village has a high school, founded in 1863, graded schools, two libraries, two private banks and three newspapers. Pop. 2,760.

WATKINS GLEN, N. Y., near the village of Watkins, in Schuyler County, a ravine noted for its picturesque scenery and its great beauty. The rocks are Devonian shale, which, during the Pleistocene period, were cut into narrow gorges by the glacial ice. The gorge here is, in places, 300 feet deep, and a narrow stream flows through, forming a succession of beautiful cascades and rapids. On the slope from the crest of the elevation overlooking a most charming part of the gorge, to the village of Watkins, is a cemetery, which for natural beauty is rarely equaled. The artist, Hope, made Watkins his home for many years, and he was laid to rest in the cemetery he so much admired. Many tourists visit the glen each year.

WATKINSON, wŏt'kĭn-sŏn, **David,** American philanthropist: b. Lavenham, Suffolk, 17 Jan. 1778; d. Hartford, Conn., 13 Dec. 1857. He came with his parents to the United States in 1795 and was for a time engaged in a New York counting-house. He established a business in Hartford with his brother William in 1800, and retired in 1841 with an immense fortune. His will bequeathed large sums to various charitable institutions and he also gave $100,000 to the Connecticut Historical Society for a reference library.

WATLALA INDIANS, a tribe of the Chinookan stock of North American Indians, who call themselves Kwikwulit, and who have also been known as Upper Chinook, Wahclellah, "Dog River, or Cascade Indians," etc. They formerly occupied the Cascades and about the Dog River, which discharges into the Columbia about midway between the Cascades and The Dalles, in Wasco County, Oregon. They numbered but 80 souls in 1854; in the next year they entered into the Wasco treaty, by which they agreed to move to the Warmspring Reservation, where a few of them now are, while the others are still about the Cascades. Their language is almost identical with that of the Wasco Indians (q.v.).

WATLING (wŏt'lĭng) **STREET**, England, one of the great Roman roads, beginning at Dover, passing through Canterbury and Rochester to London and thence to Chester and York, and north in two branches to Carlisle and the Wall in the neighborhood of Newcastle. Traces of the ancient road are still found in many parts of its course, and in some it is still an important highway; a street in London retains its name. It was the line of division in the treaty between Alfred and Guthrum the Dane, and it is still the boundary between Warwickshire and Leicestershire. Of the origin of Watling nothing is now remembered; it was formerly written Wæclinga Stræt, and is supposed to be a corruption of Stratum Vitellianum; a trace of the title survives in the name Wattlesborough, a place on Watling street near Wroxeter (Uriconium).

WATLINGS (wŏt'lĭngz) **ISLAND**, one of the Bahamas, British West Indies, lying 220 miles northeast of Cuba. It is 18 miles long and has a lagoon near the centre. It is fertile, but sparsely inhabited. It is now generally admitted to be the first landing place of Columbus called by him San Salvador. Pop. about 617.

WATMOUGH, James, United States naval officer: b. Whitemarsh, Pa., 30 July 1822; d. Washington, D. C., 18 Jan. 1917. He was educated at the University of Pennsylvania, and from 1843–44 was acting midshipman. He served in the Mexican War, and participated in the capture of California. In the Civil War he commanded the South Atlantic Squadron and took an active part in the operations on Stone River and James and John Islands. Later he became general pay inspector of the navy, and from 1873–77 was paymaster-general. In 1884 he was retired and in 1906 was created rear-admiral.

WATROUS, Harry Wilson, American artist: b. San Francisco, Cal., 17 Sept. 1857. He studied at Atelier Bonnat and at Julien Academy, Paris, and later established himself in New York. He specializes in studies of city life, his paintings being usually of a small size, exquisitely finished and occasionally of somewhat daring conception. He was married to Elizabeth Nichols, also an artist, in 1887. Among his works are 'Passing of Summer' (Metropolitan Museum, New York); 'An Auto Suggestion' (Buffalo Fine Arts Academy); 'A Study in Black' (Saint Louis Museum), and many works in private collections.

WATSEKA, wŏt-sē'kȧ, Ill., city, county-seat of Iroquois County, on the Iroquois River, and on the Chicago and Eastern Illinois and the Toledo, Peoria and Western railroads, about 75 miles south of Chicago and 100 miles east of Peoria. It is in an agricultural and stock-raising region. The chief manufacturing establishments are flour and grist mills, planing mills, knitting mills, brick and tile works and machine shops. There are seven churches, public elementary schools, two banks and two newspapers. Pop. about 2,476.

WATSON, Alfred Augustus, American Protestant Episcopal bishop: b. New York, 21 Aug. 1818; d. 21 April 1905. He was graduated from the University of New York in 1837, studied law and in 1841 was licensed to practise in the New York Supreme Court. He then turned his attention to theology, and in 1845 took priest's orders in the Episcopal Church. During the Civil War he served as chaplain in the Confederate army, and in 1884 was consecrated bishop of East Carolina.

WATSON, Clarence Wayland, American legislator: b. Fairmont, W. Va., 8 May 1864. He was educated in the public schools of Marion County and since his youth has been engaged in coal mining in West Virginia. He organized several companies which were later consolidated as the Consolidated Coal Company, with mines in West Virginia, Maryland, Pennsylvania and Kentucky, of which he was president until 1911, and since served as chairman of the board. He is interested in many other industrial and financial establishments. Mr. Watson was delegate to the Democratic National Convention at Denver in 1908 and on 25 Jan. 1911 was elected United States senator from West Virginia, for the unexpired term of the late S. B. Elkins. Senator Watson has served on the Democratic National Committee since 1916. On 25 March 1918 he was commissioned lieutenant-colonel and was detailed to the Ordnance Department.

WATSON, David T., American lawyer: b. Washington County, Pa., 2 Jan. 1844; d. 1916. He was graduated from Washington and Jefferson College in 1864, studied law at Harvard for two years, was admitted to the bar and successfully engaged in law practice in Pennsylvania. In 1903 he was chosen one of the three counsel for the United States before the Alaskan Boundary Commission. He wrote an important brief for the government in the cases against the Standard Oil corporation about 1909.

WATSON, Elkanah, American agriculturist: b. Plymouth, Mass., 22 Jan. 1758; d. Port Kent, N. Y., 5 Dec. 1842. He was apprenticed at 15 to John Brown of Providence, founder of the famous mercantile firm, and when 19 was intrusted by him with $50,000 to be invested in cargoes for the markets of Europe. He made the journey to Charleston successfully and his journal, subsequently published, is the best existing account of the principal towns of the colonies at the time of the Revolution. He opened a branch house in Nantes, France, in 1779, meeting with much success for three years, when he lost his property through the crash of French finances. He returned to America in 1784, engaged in trade between South Carolina and Haiti until 1788, and in 1789 removed to Albany, where he was an active promoter of public enterprises. He projected an internal canal for New York State, founded the Albany Bank, organized the first agricultural society in New York, aided the establishment of western stage routes, and was an earnest worker for improved educational advantages. He removed to Port Kent on Lake Champlain in 1828. He published 'Tour in Holland' (1790); 'History of Western Canals in the State of New York' (1820); 'History of Agricultural Societies' (1820). Consult Watson, Winslow, C., 'Men and Times of the Revolution, or Memoirs of Elkanah Watson' (1855).

WATSON, George Lennox, English naval architect: b. Glasgow, 30 Oct. 1851; d. 12 Nov. 1904. After a five-years' connection (1867–71) with shipbuilding firms he established himself

WATSON, John Fanning, American antiquary: b. Batsto, N. J., 1780; d. Germantown, Pa., 23 Dec. 1860. He was a bookseller in Philadelphia for many years and made a careful study of early and Revolutionary history. His publications include 'Annals of Philadelphia' (1830); 'Historic Tales of the Olden Times in New York' (1832); 'Annals of New York City and State' (1846); 'History of the United States' (1856).

WATSON, Musgrave Lewthwaite, English sculptor: b. Hawkdale, Cumberland, near Carlisle, 1804; d. London, 28 Oct. 1847. Meeting Flaxman in London in 1823 he gained the friendship of that sculptor, through whose influence he was admitted to the schools of the Royal Academy. He subsequently visited Rome, working under Chantrey (q.v.) and Behnes. His productions include a terra cotta relief, 'Suffer Little Children to Come Unto Me'; and statues of Flaxman, Nelson, Chaucer and Queen Elizabeth.

WATSON, Paul Barron, American author: b. Morristown, N. J., 25 March 1861. He was graduated from Harvard in 1881, subsequently studied law and was admitted to the bar and has practised in Boston. His published writings are a 'Bibliography of the Pre-Columbian Discoveries of America,' privately printed in 1881, and included in the fourth (enlarged) edition of 'America Not Discovered by Columbus,' by R. B. Anderson (q.v.); 'Marcus Aurelius Antoninus' (1884), the first extended biography of the subject in English; and 'The Swedish Revolution under Gustavus Vasa' (1889).

WATSON, Richard, English Anglican prelate: b. Heversham, Westmoreland, August 1737; d. Calgarth Park, Westmoreland, 4 June 1816. He was graduated from Trinity College, Cambridge, in 1759, became professor of chemistry there in 1764 and in 1771 was appointed regius professor of divinity. He became archdeachon of Ely in 1780 and in 1782 was consecrated bishop of Llandaff. His writings include 'An Apology for Christianity' (1776); 'Chemical Essays' (5 vols., 1781–88); 'An Apology for the Bible' (1796), etc. Consult his son Richard, 'Anecdotes of the Life of Richard Watson' (1817).

WATSON, Richard, English Methodist clergyman: b. Barton-upon-Humber, Lincolnshire, 22 Feb. 1781; d. London, 8 Jan. 1833. He joined the Wesleyan Methodists at 15 and began preaching. He was ordained in 1800 and shortly afterward joined the Methodists of the New Connection, returning to the Wesleyans in 1812. He was appointed secretary of the Wesleyan Missionary Society in 1817 and in 1826 was president of the conference. He was for a time editor of the Liverpool *Courier* and wrote 'Apology for the People Called Methodists' (1800); 'Life of the Rev. John Wesley' (1831); 'A Biblical and Theological Dictionary' (1831); 'An Exposition of the Gospels of Matthew and Mark' (1833), etc. His collected works were edited by Thomas Jackson, in 13 vols., 1834–37, with 'Memoir.'

WATSON, Robert Spence, English publicist and lawyer: b. Gateshead, 8 June 1837; d. 1911. He was educated at University College, London, and established a law practice in Gateshead and Newcastle. He was president of the National Liberal Federation in 1890–1902 and has taken an active part in educational movements in Newcastle. He is also known for his writings on economic subjects, particularly the labor question. His publications include 'Industrial Schools' (1867); 'Higher Education in Boroughs' (1868); 'The History of English Rule and Policy in South Africa' (1879); 'Irish Land Law Reform' (1881); 'The Relations of Labor to Higher Education' (1884); 'Boards of Conciliation and Arbitration and Sliding Scales' (1886); 'The Peaceable Settlement of Labor Disputes' (1889); 'Labor, Past, Present and Future' (1889); 'The Recent History of Industrial Progress' (1891); 'The Duties of Citizenship' (1895); 'Reform of the Land Laws' (1906), etc.

WATSON, Sereno, American botanist: b. East Windsor Hill, Conn., 1 Dec. 1826; d. Cambridge, Mass., 9 March 1892. He was graduated from Yale in 1847, studied medicine at the University of New York and in 1867–69 was botanist to the government exploration of the 40th parallel under Clarence King (q.v.). In 1871 he became assistant curator at the Gray Herbarium at Harvard and from 1874 until his death was curator there. He was elected Fellow of the National Academy of Sciences in 1889. Among his publications are 'Botany'; Vol. V of 'Reports on the Geological Exploration of the 40th Parallel' (1871); 'Bibliographical Index to North American Botany, Part I, Polypetalæ' (1878); with W. H. Brewster and Asa Gray, 'Botany of California' (2 vols., 1876–80), etc.

WATSON, Thomas, English poet: b. London, about 1557; d. 1592. While his fame may seem to have been eclipsed by that of Spenser and Sidney, among his contemporaries he was equally popular for his pastoral and love poetry. He lived in a learned age and translated the 'Antigone' of Sophocles into very elegant Latin. His 'Meliboeus, Thomæ Watsoni; seu, Ecloga in Obitum Domini Francisci Walsinghami, Equitis Aurati' (1590) was a graceful Virgilian tribute to the memory of the statesman and diplomat Francis Walsingham (q.v.). His sonnets, 'Tears of Fancie; or Love Disdained,' evidently gave suggestions to Shakespeare in the composition of his 'Sonnets.' Consult Arber, 'English Reprints' (1892).

WATSON, Thomas Edward, American lawyer and politician: b. Columbia County, Ga., 5 Sept. 1856. He entered Mercer University but did not complete the course there and then took up the study of law and was admitted to the bar in 1875. He began the practice of his profession at Thompson, Ga., and rapidly attained a reputation as one of the leading lawyers of the State. In politics he was at first a Democrat; was elected to the State legislature in 1882 and served as Democratic elector-at-large in 1888. He was active in the Farmers' Alliance movement and finally affiliated himself with the People's Party; in 1890 he was elected to Congress on the Populist ticket and for some time edited a Populist paper at Atlanta. While in Congress he obtained the first appropriation for the rural free delivery of mail. He was the nominee of the People's Party for Vice-President in 1896 and for President in 1904 and in 1908 of the Populist Party. His publications include 'The Story of France' (1898); 'Life of Na-

poleon' (1902); 'Life and Times of Thomas Jefferson' (1903); 'Handbook of Politics and Economics' (1908); 'The Story of the South and West' (1911); 'The House of Hapsburg' (1915), etc.

WATSON, William, American scientist: b. Nantucket, Mass., 19 Jan. 1834. He was graduated from the Lawrence Scientific School of Harvard in 1857; was an instructor there in 1857–59; in 1859–63 was in Europe collecting information on technical education, which, when communicated to W. B. Rogers, was made the basis of the organization of the Massachusetts Institute of Technology; and from 1865 to 1873 was professor of mechanical engineering and descriptive geometry in that institution. In 1884 he was elected secretary of the American Academy of Arts and Sciences. In addition to numerous technical papers he has published various writings, including 'Technical Education' (1872); 'Course in Descriptive Geometry' (1873); 'Courses in Shades and Shadows' (1889); 'The Civil Engineering, Architecture and Public Works of the Paris Exposition of 1889' (1891); and 'The International Water Transportation Congress, Chicago, 1893' (1894).

WATSON, Sir William, English poet: b. Burley-in-Wharfedale, Yorkshire, 2 Aug. 1859. He was privately educated and in 1880 published his first volume of verse, 'The Prince's Quest and Other Poems,' which showed the influence of Keats and William Morris and found favor with Rossetti. In 1884 he issued his 'Epigrams of Art, Life and Nature,' containing much highly-finished work, but it was not till the publication of 'Wordsworth's Grave and Other Poems' in 1890 that he gained adequate recognition. The volume of his 'Poems' published in 1892 was a reprint of the 1890 volume with the addition of 26 new pieces. Of 'Lachrymæ Musarum and Other Poems' (1892), the title-poem is a fine eulogy of Lord Tennyson. 'The Eloping Angels' followed in 1893, 'Odes and Other Poems' in 1894 and 'The Father of the Forest and Other Poems' in 1895. To 1896 belong two volumes of sonnets on the Armenian atrocities, with the titles 'The Year of Shame' and 'The Purple East'; to 1897, 'The Hope of the World and Other Poems.' His 'Collected Poems' (1898) ought rather to be called 'Selected Poems,' since from them are excluded all of the 1880 and 1893 volumes, more than half of the 'Epigrams,' most of 'The Year of Shame' and portions of the other volumes. He wrote in 1902 one of the more prominent odes on the coronation of Edward VII and in 1903 'For England.' He has written in prose a volume of literary essays, 'Excursions in Criticism' (1893). In 1909 he brought out 'New Poems,' in 1913 'The Muse in Exile,' in 1916 'Retrogression and Other Poems,' in 1917 'The Man Who Saw.' Watson's work is carefully wrought, reflective in tone and marked by an air of distinction. It has been sometimes criticized as occasionally too closely an echo of greater poets. He was prominently mentioned among the possible successors to Tennyson and Alfred Austin in the laureateship but the honor went elsewhere. In 1917 he received the honor of knighthood.

WATSONVILLE, wŏt'sŏn-vĭl, Cal., city in Santa Cruz County, on the Pajaro River and on the Southern Pacific Railroad, about five miles from Monterey Bay, an arm of the Pacific Ocean and 18 miles southeast of Santa Cruz. It is in an agricultural and fruit-growing region. Sugar beets are one of the chief products grown in the vicinity. The principal manufacturing establishment is the sugar beet factory; which has a beet-crushing capacity of over 1,000 tons and a sugar manufacturing capacity of over 200 tons each day. There are four banks and two daily newspapers. Pop. 6,000.

WATT, wŏt, **James,** Scottish engineer: b. Greenock, Renfrewshire, 19 Jan. 1736; d. Heathfield, near Birmingham, Staffordshire, 25 Aug. 1819. Having determined to adopt the trade of mathematical instrument maker, he spent a year in London learning the art, in which he attained great dexterity and after his return endeavored to set himself up in business in Glasgow. In this he might not have succeeded owing to the opposition of other workers in the trade, had he not been appointed (1757) mathematical instrument maker to the university, which was outside of the jurisdiction of the Glasgow municipality. While thus employed he was also active in preparing surveys and reports in connection with canal, river and harbor work. It was during this period that he thought of and completed most of his improvements of the steam-engine. The idea of a separate condenser first occurred to him in 1764 and in January 1769 he took out the patent for the improvements of the steam-engine in which this idea was applied. Previous to Watt's time the cylinder itself had been used as a condenser and the jet of cold water introduced into the cylinder to condense the steam so reduced the temperature of the cylinder that three times as large a supply of steam (so Watt estimated) was demanded as was really needed. Watt set to work to condense the steam in a separate receptacle. The change was so important as to make him almost the inventor of the modern engine. But it was not until the year 1774 that he united with Matthew Boulton (q.v.), a manufacturer at Birmingham, in order to carry his improvements into execution. In consequence of this he removed to Soho, near Birmingham, where the establishment in which his steam-engines were manufactured soon acquired a European fame. He retired from the business in 1800, when his patent, which had been renewed in 1775 for 25 years, expired. Watt was a Fellow of the Royal Societies both of London and Edinburgh and one of the few natives of Great Britain who have been elected members of the National Institute of France. Besides the expedient of the condenser, Watt made also other improvements in the steam-engine. He devised the sun-and-planet gear-wheel, made use of the expansion principle to obtain the double engine, applied the governor to the regulation of the speed of steam-engines and invented the throttle-valve. He built the first indicator for drawing a diagram of steam pressure and also patented a fuel-saving furnace, invented copying ink and independently discovered the chemical composition of water. He had a retentive memory and the range of his reading was very wide. Chemistry, architecture, music, law, metaphysics and language were the principal subjects which, in addition to physical science and its practical applications,

engaged his attention and in all of them his knowledge was wonderfully extensive, minute and accurate. (For an account of the improvements that Watt effected in the steam-engine see STEAM; STEAM-ENGINE). The significance of his work places him among the foremost of inventors. Consult Muirhead, 'Origin and Progress of the Mechanical Inventions of James Watt' (1854); a 'Life' abridged from the preceding (1858); Smiles, 'Lives of Boulton and Watt' (1865); Thurston, 'The Growth of the Steam-Engine' (1879) and an article by Cowper in the 'Transactions' of the Institution of Mechanical Engineers for 1883.

WATT, *in electricity,* the unit of activity or rate of doing work, named after James Watt (q.v.). See ELECTRICAL TERMS, Vol. 10, p. 167; ELECTRICAL UNITS, Vol. 10, p. 168.

WATT-HOUR. See ELECTRICAL TERMS.

WATTEAU, vä-tō, **Jean Antoine,** French painter: b. Valenciennes, 10 Oct. 1684; d. Nogent-sur-Marne, 18 July 1721. His parents, whose situation in life was humble, with difficulty contrived to give him the instructions of a very inferior master in the country. In 1702 he went to Paris, in company with a scene-painter, with whom he continued to work for a few months. Soon afterward he found employment with one Claude Gillot, who, although only a painter of decorations for ballet and a designer of costumes and of patterns for tapestry, was a true artist. With him he found an opportunity of practising in all these branches of art and when he left him he found another master in Claude Audran, a very able man, keeper of the Luxembourg, who was of great service to him in opening to him the famous gallery of the palace in which Rubens had painted in allegory the history of Marie de Médicis. From the study of the great Flemish master he improved his coloring and when he left Audran in 1709 he was a consummate master of his art and a painter of "Fêtes Galantes." He now began to paint on his own account, but met at first with little encouragement. He failed to secure the "Prix de Rome," which would have enabled him to visit Italy, but soon afterward scored a triumph by his 'Un Départ de Troupes.' He was admitted to the Académie in 1717 as a painter of "Fêtes Galantes" and produced many pictures whose power and grace in drawing and coloring his rivals strove in vain to emulate. His subjects were all genre, military and civil. He excelled in reproducing the costumes, airs and graces of the fashionable world of his time. His 'L'occupation selon l'Age' sold in 1891 for $27,300. The finest collection of Watteau paintings is in Berlin, others are to be seen in the Wallace collection, London, in the Louvre, Paris, and in the Petrograd, Vienna, Edinburgh and Glasgow galleries. Consult Goncourt, E., 'Catalogue raisonné de l'œuvre peint, dessiné et gravé d'Antoine Watteau' (Paris 1875); Pater, W., 'A Prince of Court Painters' (in 'Imaginary Portraits' London 1887); Foster, J. J., 'French Art from Watteau to Trud'hon' (London 1905); Mauclaire, C., 'De Watteau à Whistler' (Paris 1905); Pilon, E., 'Watteau et son école' (Brussels 1912); Staley, E., 'Watteau and his school' (London 1902).

WATTERSON, wŏt'ėr-sŏn, **Henry,** American journalist: b. Washington, D. C., 16 Feb. 1840. He was privately educated, and began journalistic work as editorial writer for the Washington *Star.* In 1861 he joined the Confederate army as a private, and later was aide-de-camp to Generals Forrest and Polk. In 1862 he withdrew from the army to edit the *Rebel* at Chattanooga, a daily paper, recognized as an organ of the Confederate government, but in 1864 returned to the army, and had part in General Johnston's campaign, and the siege of Atlanta. After the war he revived the publication of the Nashville *Republican Banner*; and in 1867 became editor of the Louisville *Journal.* This paper he united with the *Courier,* under the name of the *Courier-Journal,* of which he became editor-in-chief and which he has made one of the leading Southern newspapers. He has been active in politics as a member of the Democratic party, although a leader in the Liberal Republican program of 1872; was delegate-at-large to every Democratic National Convention from 1872-92, and was permanent chairman of that of 1876. He was a member of Congress in 1876-78, and hotly opposed all greenback ideas. Though a staunch supporter of Tilden for the Presidency, yet in Congress he was one of the leaders in obtaining a peaceable adjustment of the election dispute, and approved the appointment of the Electoral Commission, 1877 (q.v.). In 1896 he refused to support the Chicago platform of the Democratic party, and was affiliated with the Gold Democrats. As a defender of the tariff, he was not over strenuous, believing that its main purpose was to raise revenue. He was ever antagonistic to trust policies and the dominance of industry by great capital. As speaker and editor he has been a consistent advocate of free trade, and particularly of a policy of conciliation between the North and the South. He retained his vigor of utterance and influence in politics in his latter days. He has published 'Oddities of Southern Life and Character' (1882); 'History of the Spanish-American War' (1899); and 'Abraham Lincoln' (1899). In 1911 he was conspicuous as being among the first to urge the fitness of Woodrow Wilson for the Presidency. His famous slogan "To hell with the Hapsburgs and Hohenzollerns" in 1917 was largely instrumental in arousing the United States to war against the German atrocities and brutal disregard of the rights of neutral nations. On 2 March 1919 a world-wide tribute was paid him in the special 'Marse Henry edition' of the Louisville *Courier-Journal* in which over 200 thinkers and statesmen of the world voiced their esteem of the veteran editor.

WATTLE-BIRD, or WATTLE-CROW, an Australian honey eater (*Anthochæra carunculata*), so named from the large reddish wattles on its neck. It is about the size of a magpie, and is of bold, active habits.

WATTLES, arborescent shrubs (*Acacia*) of Australia and Tasmania, in some places growing to good-sized trees. They have foliage which is compound or reduced to phyllodia, and pretty, crowded flowers, in globose or cylindrical heads. The wattles furnish a gum, used as an adhesive in cotton-printing; the stems make poles, which are serviceable for many

Hood, 'Life' (1875); Julian, 'Dictionary of Hymnology' (1892).

WATTS, Mary Stanbery (Mrs. Miles Taylor Watts), American author: b. Delaware County, Ohio, 4 Nov. 1868. She was educated at the Convent of the Sacred Heart, Cincinnati, and early engaged in literary work. She is well known as a writer of short magazine fiction and of novels dealing with American life. Author of 'The Tenants' (1908); 'Nathan Burke' (1910); 'The Legacy' (1911); 'Van Cleve' (1913); 'The Rise of Jennie Cushing' 1915); 'The Rudder' (1916); 'The Boardman Family' (1918), etc.

WATTS, Thomas Hill, American politician: b. Butler County, Ala., 3 Jan. 1819; d. Montgomery, Ala., 16 Sept. 1892. He was graduated from the University of Virginia in 1840, established a law practice in Greenville, Ala., was elected to the State legislature in 1842, 1844–45, and to the State senate in 1853. He opposed the secession movement, but upon the secession of Alabama accepted the situation. He was appointed colonel in the Confederate army and fought at Shilo, but resigned shortly afterward to become attorney-general in the Confederate Cabinet. He was elected governor of Alabama in 1863, but was unseated by the Federal government at the close of the war. He was thereafter engaged in law practice at Montgomery, and with the exception of 1880–81, when he served in the legislature, held no further public office.

WATT'S DYKE. See Offa's Dyke.

WATTS-DUNTON, Theodore, English poet, critic and novelist: b. Saint Ives, Huntingdonshire, 12 Oct. 1832; d. 17 June 1914. He was educated privately at Cambridge and for a time studied law, but had already gained a reputation as a writer of sonnets when he joined the staff of the *Examiner* as literary and art critic. Later he joined the *Athenæum* staff, and for many years was one of the chief contributors to that review, his criticisms of poetry being of the most illuminating character. In 1897 he published a poem entitled 'Jubilee Greeting at Spithead to the Men of Greater Britain,' which met with wide appreciation; and in the same year collected in 'The Coming of Love, and Other Poems,' some of the more important of his poetical contributions. 'Aylwin,' a novel or romance published in 1898 (privately printed in 1883), forms a striking prose counterpart to the 'Coming of Love,' and contains excellent pictures of gypsy life. Watts-Dunton has also contributed largely to the *Nineteenth Century* and other periodicals. Several of the notices in Ward's 'English Poets' are from his pen, and the valuable critical article on poetry in the Encyclopædia Britannica' was written by him. He and Swinburne (q.v.) were intimate friends. Later publications are 'The Christmas Dream' (1901), and 'The Renaissance of Wonder' (1902). On occasion Watts-Dunton makes free use of the Romany dialect, which he has carefully studied. His best work is probably the critical, especially that dealing with the principles of verse. Consult Miles, 'Poets and Poetry of the Century,' (Vol. IV, 1901); also an article in the *Idler* (Vol. V), and one by Nicoll in the *Contemporary* (Vol. LXXIV).

WAUGH, wâ, **Arthur,** English author: b. Midsomer Norton, Somerset, 24 Aug. 1866. He was graduated from Oxford in 1889, became a journalist in London in 1890, was London correspondent of the New York *Critic* in 1893–97, and in 1894 was sub-editor of the London *New Review*. He acted as literary adviser to Kegan Paul and Company in 1895–1902, and is now managing director of the London publishing firm of Chapman and Hall. He has written 'Gordon in Africa' (1888); 'Alfred, Lord Tennyson, a Study' (1892); 'Legends of the Wheel' (1898), etc.; and has edited Johnson's 'Lives of the Poets' (6 vols., 1896); Biographical edition of Dickens (19 vols., 1902–03), and other works.

WAUGH, Frederick Judd, American artist: b. Bordentown, N. J., 13 Sept. 1861. He studied at Pennsylvania Academy, Philadelphia, and in Paris, and lived and worked abroad in 1892–1907. He exhibited at the Paris Salon and at the Royal Academy, London, and also worked as a newspaper illustrator in London. He lived at Montclair, N. J., after his return from Europe, and gained a considerable reputation as a painter of marines. His work is well represented in both public and private collections. He was elected to the National Academy of Design in 1911. Among his works are 'The Roaring Forties' (The Metropolitan Museum, New York); 'Surf and Fog, Monhegan' (Art Institute, Chicago); 'After a Northeaster' (National Gallery, Washington); 'The Blue Gulf Stream' (Pennsylvania Academy, Philadelphia), etc.

WAUKEGAN, wâ-kē'gan, Ill., city, county-seat of Lake County, on Lake Michigan, and on the Chicago and Northwestern, the Elgin, Joliet and Eastern (Belt Line) railroads, 30 miles north of Chicago and 50 miles south of Milwaukee. There are two electric lines which connect the city with the lake ports and nearby villages and towns. The city is on a bluff about 80 feet above the lake. There is a fine beach and a good harbor, which has been improved, thus giving Waukegan the advantages of the lake traffic. It is in an agricultural region, but the city is best known for its manufacturing industries. The chief industrial establishments are steel and wire works, which have about 2,500 employees; sugar refineries, 2,000 employees; brass and iron works, a tannery, wood-working factory, wrapper factory, roofing material works, electric scale works and organ-stop factory. The city ships large amounts of lumber, coal, salt, iron, grain and manufactured products. The principal public buildings are the county courthouse, the municipal buildings, the Jane McAlister Hospital, the library, the churches and the schools. There are 15 churches, a high school, public and parish elementary schools, and the Carnegie public library. A United States naval training station is close by. There are three banks and two daily newspapers. The government is conducted on the commission plan. The place was settled in 1835 by Thomas Jenkins; was incorporated in 1849, and chartered as a city in 1859. Pop. 19,571.

high school established in 1871, grammar and primary schools, an opera house and a town hall. Pop. 5,119.

WAVERLY, Ohio, village, county-seat of Pike County, on the Scioto River, and on the Norfolk and Western, and Ohio Southern railroads, 57 miles south of Columbus. It is in an agricultural and stock-raising region, and contains flour and saw mills, tanneries, distilleries and furniture factories. There is a high school with a school library of over 1,000 volumes; two banks and two newspapers. Pop. 2,100.

WAVES OF ASSAULT. In modern warfare the intense effort demanded of assaulting troops, and the successive attacks which they must make necessitate a deep formation. The several echelons thus constituted have been given the name of *waves*. But this term does not signify a uniform formation. The foremost waves, generally the first and the second, advance in line; those following are in various formations, for example, in lines of small columns. Moreover, to facilitate the leading of the echelons, the waves are formed by the simultaneous advance of tactical units not deployed in single line but themselves extended in the direction of depth, from which it results that a company or battalion will form a part of several successive waves. Formation for the assault does not consist of the deployment of rigid lines capable only of a movement straight to the front, but, on the contrary, of placing side by side tactical units which are capable of being led and even manœuvred.

The waves are crowded into the first-line trench and the parallels in the immediate rear, sometimes in double rank. They dash forward, following each other at short distances so as to rapidly cross the zone of hostile barrage fire. Theoretically an assaulting battalion leaves a single block of its parallels of departure and then while marching takes the distances prescribed between waves. In no event should these waves close up automatically on the leading wave, as its only effect would be in thickening the skirmish line, increasing the losses, and mixing the units. To avoid such effects, when the first wave has crossed the advanced hostile trench it continues its advance toward the objective assigned to it. The other waves follow in good order. They engage successively according to the necessities of the situation under orders from the commanders of the several units. The assault is now followed by a combat in the interior of the position. At certain points the enemy yields, at others he resists stubbornly. The assailants, rallying about the officers that remain, rush into the opening and surround the nuclei of resistance. As soon as the trench is carried the attack pauses only long enough to reform, and the groups of assailants then dash into every opening that offers. Their audacity constitutes their strength. These scattered combats bring the assailants in contact with a new line of defense. If it is occupied, they dig themselves in, in order to form a line of departure for an assault by the reinforcements.

EDWARD S. FARROW,
Consulting Military and Civil Engineer.

WAVES AND WAVE-MOTION. Wave is the name commonly given to a disturbance of the surface of a body in the form of a ridge and trough, propagated by forces tending to restore the surface to its figure of equilibrium, the particles not advancing with the wave. A more complete and scientific definition of a wave is that particular form of aggregation assumed by the molecules between the nearest two consecutive surfaces in which similar phases simultaneously exist throughout. The theory of wave-motion is of the utmost importance in all physical science, and the general investigation of the form and rate of propagation of waves demands the application of the highest resources of mathematics. The theory of even such comparatively simple cases as the wind-waves in deep water (the Atlantic roll, for instance) though easily enough treated to a first, and even to a second and third approximation, has not been thoroughly worked out, as fluid friction has not been fully taken into account. To find the rate at which an undulation runs along a stretched cord, as for instance, when a harp-string is sharply struck or plucked near one end, a very simple investigation suffices. Suppose a uniform cord to be stretched with a given tension in a smooth tube of any form whatever, we may easily show that there is a velocity with which the cord must be drawn through the tube in order *to cease to press on it at any point*, that is, to move independently of the tube altogether. For the pressure on the tube is due to the tension of the cord; and is relieved by the centrifugal force when the cord is in motion. If T be the tension of the cord, r the radius of curvature of the tube at any point, the pressure on the tube per unit of length is $\frac{T}{r}$. If m be the mass of unit length of the cord, v its velocity, the centrifugal force is $\frac{Mv^2}{r}$. These are equal in magnitude, and so destroy each other, if $T = mv^2$. Hence, if the cord be pulled through the tube with the velocity thus determined, there will be no more pressure on the tube, and *it may therefore be dispensed with*. If we suppose the tube to have a form such as that in Fig. 1, where the extreme

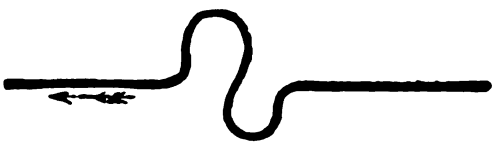

FIG. 1

portions are in one straight line, the cord will appear to be drawn with velocity v, along this, the curved part being occupied by each portion of the cord in succession; presenting something like the appearance of a row of sheep in Indian file, jumping over a hedge. To a spectator moving in the direction of the arrow with velocity v, the straight parts of the cord will appear to be at rest, while an undulation of *any* definite form and size whatever runs along it with velocity v, in the opposite direction. This is a very singular case, and illustrates in a very clear manner the possibility of the propagation of a *solitary* wave. Thus we prove that the velocity with which an undulation runs along such a cord is the square root of T divided by m.

If l be the length of the cord in feet, w its whole weight, W the appended weight by which it is stretched, $g = 32.2$ feet, the measure of the earth's gravity, this becomes $\left(\frac{W}{w} lg\right)$. This formula is found to agree almost exactly with the results of experiment. We can easily see why it should be to some small extent incorrect, because we have supposed the cord to be inextensible and perfectly flexible, which it cannot be; and we have neglected the effects of extraneous forces, such as gravity, the resistance of the air, etc.

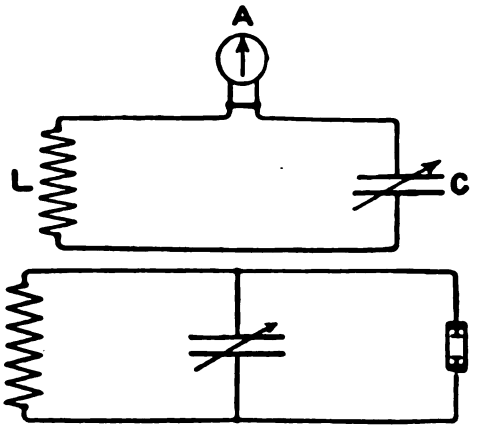

FIG. 2.— Ammeter in Circuit to Indicate Resonances.

In gometrical investigations it has been proved that the velocity with which a sound wave travels is proportional to $\left(\frac{p}{d}\right)^{\frac{1}{2}}$ where p is the pressure, and d the density of the air. The easiest mode of doing this is to express, in terms of these and other quantities, the equation given by the laws of motion, Mass × Acceleration = Difference of Pressures, and to assume that Hooke's law holds, even during the *sudden* compression of air. The foregoing formula shows that the velocity of sound is not affected by the pressure of the air (the height of the barometer) since, in still air, p is *proportional* to d. The velocity does depend on the temperature, being, in fact, proportional to the square root of the temperature measured from absolute zero. We also see from the formula that the velocity is inversely as the square root of the density of the gas— the pressure being the same. Thus a sound wave travels about four times faster in hydrogen than in air. Also, within the limits of approximation we have used, the velocity does not depend upon the intensity, pitch, or quality of the sound.

WAVEY, the common name in the Hudson Bay region for the smaller wild geese, especially the snow-goose. See GEESE.

WAX, fatty solid animal substance, of which the typical sort is called beeswax. Various similar substances of vegetable and animal origin bear the name. Beeswax is secreted by bees in constructing their hives, and a very similar vegetable product enters into the composition of the pollen of flowers, covering the envelope of the plum and of other fruits, especially of the berry of the *Myrica cerifera*, and in many instances forming a kind of varnish to the surface of leaves. It is distinguished from fat and resinous bodies by its not readily forming soaps when treated with alkaline solutions. Common beeswax is always more or less colored, and has a distinct, peculiar odor, of both of which it may be deprived by exposure in thin slices to air, light and moisture, or more speedily by the action of chlorine. At ordinary temperatures wax is solid and somewhat brittle; but it may be easily cut with a knife, and the fresh surface presents a characteristic appearance, to which the name of waxy lustre is applied. Its specific gravity is 0.96. At 155° F. it enters into fusion, and boils at a high temperature. Heated to redness in a closed vessel it suffers decomposition, yielding products very similar to those which are procured under the same circumstances from oil. It is insoluble in water, and is only dissolved in small quantities by alcohol or ether.

In bleaching wax the wax must be melted, with a degree of heat not sufficient to alter its quality, in a caldron so disposed that the melted wax may flow gradually through a pipe at the bottom of the caldron into a large wooden cylinder that turns continually round its axis, and upon which the melted wax falls. As the surface of this cylinder is always moistened with water, the wax falling upon it does not adhere but quickly becomes solid and flat, and acquires the form of ribbons. The continual rotation of the cylinder carries off these ribbons as fast as they are formed, and distributes them through the tub. When all the wax ribbons to be whitened is thus formed, it is to be put upon large frames covered with linen cloth, which are supported about a foot and a half above the ground in a situation exposed to the air, the dew and the sun. If the weather be favorable, the color will be nearly discharged in a few days. It is then to be re-melted and formed into ribbons and exposed to the action of the air as before. These operations are to be repeated till the wax is rendered perfectly white, when it is cast into cakes or other commercial form.

The principal applications of wax are to make candles and medicinal cerates; to give a polish to furniture or floors, for which purpose it is largely used in the United States; to form a lute or cement, for which it is used by chemists; and to serve as a vehicle for colors. By modern painters colors previously prepared in oil are sometimes diluted just before being laid on in a mixture of wax and oil of turpentine. This practice is much resorted to by French artists, especially in mural paintings. The object is to keep the painting free from that lustrous appearance which often renders it difficult to be seen properly in consequence of reflection. Wax also forms a principal ingredient in modelers' wax and gilders' wax. In the former the other ingredients are druggists' lead-plaster, olive oil, yellow resin, and whiting; and in the latter verdigris and sulphate of copper. Sealing-wax is not properly a wax at all, but is composed of resin lac and some less brittle resin. The largest consump-

tion of wax takes place in Roman Catholic countries, where large quantities are required for the candles used in religious ceremonials.

Chinese wax comes from the ash-tree where it is secreted by an insect. It resembles spermaceti. Cork wax or cerin is extracted from cork by an alcoholic process. Mineral wax or ozocerite is a waxy paraffine sometimes found in coal measures. Shoemakers' wax is a mixture of pitch and tallow. Wool wax is the solid greasy product obtained from sheep washing, is used as a dressing for leather, and is an adulterant or base for ointments. See also WAX, VEGETABLE.

Wax Figures.— The employment of wax in imitative art dates from a period anterior to historical times, although, according to Pliny, the art of casting it in molds was not practised previous to the time of Lysistratus, its reputed inventor, who flourished about 300 B.C., and whose productions were chiefly portraits cast in plaster molds taken from the face. Wax portraits eventually became common, and among the Romans, who placed them in the vestibules of their houses, were regarded as an evidence of ancient nobility, as none were allowed to possess such images whose families had not borne some curule magistracy. In the Middle Ages, wax was employed in the construction of images of saints and of votive images, and those who practised sorcery melted before a slow fire wax figures of the persons against whom their incantations were directed. In the latter half of the 15th century Andrea del Verrocchio and Orsino gained considerable reputation by some figures of Lorenzo de' Medici, their joint production, which consisted of frameworks of wood or skeletons for the bodies and limbs, while the heads, hands and feet were cast in wax, painted in oil colors to counterfeit life. They were furnished with glass eyes and natural hair, and were habited in the costume usually worn by Lorenzo. The manufacture of wax figures of the size of life is still carried on to a considerable extent, but has long ceased to be considered a branch of the fine arts, no imitative skill or taste on the part of the artist being sufficient to overcome the ghastly fixedness which such images must always present, and which is the more disagreeable as the resemblance to life is closer. In the preparation of anatomical models and pathological examples, however, wax has been very advantageously employed, the invention being due to Gaetano Giulio Zummo, a famous modeler in colored wax, who flourished in the latter half of the 17th century. In the succeeding century the celebrated collection of anatomical models in the Institute of Bologna was begun under the direction of Ercole Lelli, the finest specimens being by Giovanni Manzoli and his wife, Anna Morandi Manzoli. In the Museum of Natural History at Florence are 15 chambers devoted to preparations by Fontana, Susini and other celebrated modelers; the Musée Dupuytren at Paris is famous for its morbid specimens; and almost every considerable city of Europe now has its collection.

The collection of wax figures at the Eden Musée in New York was for about 50 years prior to 1910 one of the show features of the city.

WAX, Mineral. See HATCHETTITE.

WAX, Vegetable, a solid, fatty substance, resembling animal wax, which is secreted by many plants, sometimes in large enough quantities to be of commercial importance. It forms, on foliage, a varnish or coating, which prevents excessive transpiration or wetting of the cells; and, on twigs and flower-pedicels, by its slippery surface keeps unwelcome insects from reaching the flowers and robbing them of their honey. The whitened under surfaces of some willow leaves and the bloom of fruit are composed of wax either in granules or rods or spread over the cuticle. The most familiar example in America of the hard fat or wax in quantity is on the bony nutlets of the wax-myrtles or bayberries (*Myrica*). The gray-coated drupes of *M. carolinensis* clustering on the bare twigs are conspicuous in seashore regions, after the leaves are fallen; the wax clinging to their rough, granular surfaces when melted is a greenish, hard substance, sharing the balsamic odor of the plant. It was used in colonial times as a basis for candles and for soap. Other species, of other countries, furnish a similar wax and are known as candle-berries or tallow-trees. Carnauba wax is exported from Brazil for candles and as a substitute for beeswax. It is the coating on the young leaves of *Corypha cerifera*, indigenous to tropical South America. The young leaves are removed and dried. The wax-granules may then be shaken off, in the form of a fine dust, melted and caked. A varnish-like exudation of wax, on the stems of two other South American palms, *Klopstockia cerifera* and *Ceroxylon andicola*, the wax-palm, the latter being a tall tree, slightly thickened at the centre of the trunk and crowned by a tuft of pinnate leaves. This wax is scraped off and melted. A mixture of resin and wax results, from which the latter is extracted by hot alcohol, and is then utilizable for candles. It is, however, seldom seen in commerce. Japan wax is a wax-like, hard fat, which is largely exported from Japan to Europe, in yellowish hard cakes, with a resinous, rancid odor, and often covered with a powdery efflorescence. It is mixed with or substituted for beeswax, where its rancid odor is not preventive and is extracted by several methods, such as heating under pressure or boiling from the crushed drupes of an oriental species of sumac (q.v.).

WAX-BILL, or **SENEGAL FINCH,** an African weaver-bird (*Estrilda astrilda*), one of the section of the family called bloodfinches on account of the prevalence of red in the plumage. This has long been a favorite among cage-birds and is sold by dealers all over the world. It is nearly five inches long. The beak is bright red and somewhat swollen. A bright red stripe passes between the eyes and the middle of the breast and belly is a beautiful reddish-brown. The upper surface of the body is brownish-gray, the lower surfaces lighter, everywhere traversed by very fine blackish wavy lines; wings and tail brown. They are varied much in color by breeders, bright blue tints, even, having been developed in some. Their song is not very musical, but they are pretty and affectionate to a high degree. Their food and care should be similar to those given to a canary.

WAX-FLOWER, or **MADAGASCAR JASMINE.** See STEPHANOTIS.

WAX INSECT. See SCALE INSECTS.

WAX-WING, a woodland bird of the family *Ampelidæ*, a small isolated group of birds of the northern hemisphere, characterized by their shrike-like beaks, silky brown plumage, tall erectile crests and especially by the tips of the wing and tail-quills terminating in flattened scales closely resembling red sealing-wax. There are but three species, the northern or Bohemian wax-wing (*A. garrulus*); the Siberian wax-wing (*A. phœnicoptera*), and the common North American cedar-bird (q.v.). The northern wax-wings make their home near the Arctic coasts of both continents and breed there, in trees, long before the snow has disappeared in spring. Sometimes they are not seen in the United States or Central Europe for years together; then will appear in large numbers locally. These erratic movements are doubtless due to presence or absence of food, which consists of both insects and berries (the latter mainly, of course, in winter), but were regarded by the superstitious peasantry of Europe as signs of some visitation of war or pestilence to follow. All the wax-wings are cinnamon-brown, relieved by handsome markings of black, gray and yellow.

WAXAHACHIE, wăks-ą-hăch'ē, Tex., town, county-seat of Ellis County, on the Missouri, Kansas and Texas and the Houston and Texes Central railroads, about 178 miles northeast of Austin, the State capital, and 31 miles south of Dallas. It was founded in 1847. It is in an agricultural and stock-raising region, in which are produced large crops of wheat and a good quality of cotton. The manufactories are cottonseed-oil mills, cotton compresses and flour mills. It is a cotton centre for an extensive region. The principal public buildings are the county courthouse (original cost $150,000), Trinity University, three banks, six churches, schools and a library. There are besides a daily, weekly and monthly (college) newspapers. Pop. 8,000.

WAXWORKS, the representation in wax of figures, ornaments or other articles, but in popular usage confined to that of figures of real persons. For the history and development of modeling in wax see article on *Wax Figures* under WAX. In modern public exhibitions of waxworks only the heads and hands of the figures are modeled in wax, the figures being clothed as in life; and in some cases a mechanism is added to make them capable of movement. The figures reproduced are usually those of notable personages of different periods. There is also usually a department in which startling happenings are represented, as in the "Chamber of Horrors" at the Eden Musée, New York, where notorious criminals were shown in wax. The Eden Musée was long a famous showplace of New York, but waning public interest resulted in its closing its doors in 1915. Other noted exhibits of the sort are those of Madame Tussaud (q.v.), in London, and the figures of the sovereigns of England formerly in the Tower of London.

WAXY or AMYLOID DEGENERATION. See DEGENERATION; PATHOLOGY.

WAY, Arthur S., English classical scholar; b. Dorking, 13 Feb. 1847. He was Fellow of Queen's College, Melbourne, Australia; was classical lecturer in Queen's College, Taunton, in 1870–76 and was the head of the Wesley College of Melbourne in 1882–92. In 1897 he became examiner in Latin to the Central Welsh board of secondary education. His publications include English verse-renderings of the 'Odyssey' (1880) and 'Iliad' (i–xii, 1886; xiii–xxiv, 1889); of the tragedies of Euripides (1894–98); of Horace's 'Epodes' (1898); and of Apollonius Rhodius' 'Tale of the Argonauts'; he has also published 'Letters of Saint Paul to Seven Churches and Three Friends' (1901); 'David the Captain' (1904); 'Epistle to the Hebrews' (1906); 'Orestcia' (1908); 'The Cyclops of Euripides' (1912); 'Virgil's Georgics in English Verse' (1912); 'Virgil's Æneid in English Verse' (I–III, 1916).

WAY, Right of. See REALTY.

WAY OF ALL FLESH, The, the title of a novel by Samuel Butler (q.v.) published posthumously in 1903. It is the history of three generations of the author's family and is a brilliant satire on the church, family relationships and the education of children. Not only are hundreds of facts in the author's own life minutely recorded; it is a spiritual autobiography as well. Bernard Shaw in the preface to Major Barbara, says that he learned more from Butler than anyone else in the perfection of paradoxical style and the trick of reversing moral dynamics.

WAY OF THE WORLD, The. William Congreve was already the leading playwright and one of the most elegant gentlemen of London when in 1700 in his 30th year, he brought out at Lincoln's Inn Fields 'The Way of the World' with his friend Mrs. Bracegirdle in the principle rôle of Millamant. The play was written with a conscious aspiration "to write only to the few refined." It was the author's purpose "to design some characters which should appear ridiculous, not so much through a natural folly (which is incorrigible and therefore not proper to the stage) as through an affected wit, a wit which at the same time that it is affected is also false." The venture was not entirely a success and Congreve's career as a playwright was at an end.

It may profit us to inquire why the play failed and why in spite of its failure it is hailed as one of the greatest of the world's comedies. By the time of Congreve there had been added to the over-emphasis and grotesqueness of Jonson's comedy the refining touch of Molière. Comedy now becomes an art of manners, a pattern of human ingenuity at its wittiest and best. It was Congreve's distinction that he best adapted the technique of town living to the technique of the stage. Interested in character he is even more interested in social groups:

> "poets oft in one piece expose
> whole belles—assemblees of coquettes and beaux."

The play is rendered caviare to the general by its super-abundance of dazzle, a radiance that conceals, as by principle, the real humanity of some at least of the characters. Moreover, the characters quite run away with the author in their good spirits and lavish life, leaving his plot unclear and a matter of raveled ends and hasty explanations. But these things cannot be counted faults by one who loves

distinction and was wounded at the battle of Three Rivers 3 Jan. 1776, held Ticonderoga till May 1777 and after receiving the commission of brigadier-general joined Washington in New Jersey; led a division at Brandywine 11 September and commanded the right wing and led the attack at Germantown 4 October. He made a dashing raid on the British lines in the winter of 1777–78, carrying off a great quantity of supplies, and on the night of 15 July 1779 achieved the most brilliant of the American victories in the storming of Stony Point, for which he received a gold medal and the thanks of Congress. He became a popular hero, and his nickname of "Mad Anthony" was as much a tribute to his energy and valor as it was a denotation of his recklessness in action. By a bayonet charge he rescued Lafayette in Virginia in 1782; made a daring attack on the whole British army at Green Spring (6 July), and defeated the British and Indians in Georgia. On the surrender of Charleston, S. C., by the British it was occupied by Wayne, 14 Dec. 1782. He was made brevet major-general 10 Oct. 1783, retired from the army in 1784 and became a member of the Pennsylvania legislature. He was a member of the convention of that State which ratified the Federal Constitution in 1787. Later he settled on a Georgia plantation presented to him by the State in return for his military services; and from Georgia, in 1791, he was sent to Congress, but in a contest during the next year his seat was declared vacant. In April 1792, he was made commander-in-chief of the American army, with the rank of major-general. In 1793 he took the field against the Indians in Ohio, whom he finally defeated at Maumee Rapids or Fallen Timbers and he forced them to conclude the treaty of Greenville (1795), which gave a large tract of territory to the United States. His death occurred while he was engaged in completing this service. A monument was erected to him at Waynesboro, Pa., 1809. Consult the 'Lives' by Armstrong (1834) and Moore (1845); Wayne's 'Regimental Orderly Book' on the northern campaign, edited by J. Munsell (1859); Stillé, 'Wayne and the Pennsylvania Line' (1893); Roosevelt, 'Winning of the West,' Vol. IV (1889–94); and Spears, 'Anthony Wayne' (1903).

WAYNE, James Moore, American jurist: b. Savannah, Ga., 1790; d. Washington, D. C., 5 July 1867. He was graduated at Princeton University in 1808, was admitted to the bar in 1810, and engaged in practice at Savannah. He served for two years in the Georgia legislature, was mayor of Savannah in 1823, and was judge of the Superior Court in 1824–29. He was a member of Congress in 1829–35; and was appointed by President Jackson an associate justice of the Supreme Court of the United States 9 Jan. 1835. He was a recognized authority on admiralty jurisprudence. He opposed the re-chartering of the United States Bank.

WAYNE, Neb., city, county-seat of Wayne County, on the Chicago, Saint Paul, Minneapolis and Omaha Railroad, about 95 miles north by west of Lincoln and 85 miles northwest of Omaha. It is in an agricultural region, in which the principal productions are wheat, corn, sugarbeets and potatoes. Wayne makes extensive shipments of grain, hogs, cattle, hay and vegetables. It has the Nebraska Normal College (private), a high school and public graded schools. There are four banks and two newspapers. Pop. about 2,140.

WAYNESBORO, wānz'bŭr-ō, Ga., city, county-seat of Burke County, on the Central Railroad of Georgia, about 100 miles northwest of Savannah and 30 miles south of Augusta. It was laid out as a town in 1783, and in 1888 was incorporated as a city. The chief manufactories are cottonseed-oil mills, a wagon factory, agricultural implement works, a meat-packing plant and a cotton compress. It has seven churches, one public high school or academy, and Waynesboro Academy (a private high school), elementary public schools, two banks and a newspaper. A battle was fought here during the Revolutionary War, and one during the Civil War. Pop. about 2,729.

WAYNESBORO, Pa., borough in Franklin County, on the Mont Alto and West Maryland railroads, about 48 miles southwest of Harrisburg. It is the commercial and industrial centre of quite an extent of territory. The chief manufacturing establishments are four large machine factories, employing a total of 2,500 men, also foundries, tool works, creameries, ice-machine and engine works, and a plow factory. There are four banks, two daily and two weekly newspapers. The borough is near South Mountain and Antietam Creek. The Confederate army passed through Waynesboro on the way to and from Gettysburg. Pop. about 9,720.

WAYNESBORO (Va.), **Battle of.** On 27 Feb. 1865 General Sheridan started from Winchester, Va., on his final campaign up the Shenandoah Valley, under instructions from General Grant to destroy the Virginia Central Railroad, the James River canal, capture Lynchburg, if practicable and join General Sherman, wherever he might be found in North Carolina, or return to Winchester. He had Custer's and Devin's divisions of cavalry and two sections of artillery, about 10,000 officers and men, the whole commanded by General Merritt, his chief of cavalry. At Mount Crawford, 1 March, he was met by Rosser's cavalry which was promptly dispersed, and 2 March he reached Staunton, which had been abandoned by General Early, who had fallen back eastward to a ridge west of and near Waynesboro, where he could muster only Wharton's two small brigades of infantry, Nelson's battery of six guns and Rosser's cavalry, in all not over 1,800 men. Merritt followed from Staunton, and late in the afternoon, after some artillery-firing, three of Custer's dismounted regiments moved around Early's left flank, between it and South River, while two of his brigades charged his front. Early's men made but a feeble resistance and broke in a disorderly rout, hotly pursued by the Union cavalry through Waynesboro and as far as the South Fork of the Shenandoah and to Greenwood Station, where five guns were captured and several loaded cars burned. Merritt took as prisoners 1,450 officers and men and captured 11 guns with horses and caissons complete, 200 loaded

has a horn on each side projecting forward. The genus is chiefly American, with about 15 North American species. The common weakfish (*C. regalis*) is one to two and one-half feet long, brownish blue above, with irregular brownish spots, and tinged with greenish and banded in the young; the sides silvery, abdomen white, and iris yellow; lower fins orange; a single row of very small teeth in the upper jaw and a double series in the lower; dorsals separated, and the second, with the caudal and anal, mostly covered with scales. This is one of the most abundant fishes along the entire Atlantic Coast from Cape Cod to Florida, but there have been times when the invasions of bluefish have driven them from parts of the coast. The name originated from the little resistance it makes when taken, and from the ease with which the delicate structure of the mouth enables it to break away. This is the name most employed on the New Jersey Coast, while in New England the Indian name "squeteague" is usual, and in the South sea-trout is applied to this and to the spotted *Cynoscion*. On the New Jersey Coast it appears early in the spring, being most abundant toward the end of July, and disappears late in the autumn; it is a greedy biter, and is easily taken by any soft white bait, affording great sport for about an hour on the flood tide; it swims in shoals near the surface and requires a line slightly if at all leaded. In summer it is abundant about the mouths of rivers, where the water is brackish, and sometimes ascends far up, having been taken in the Hudson 50 miles above New York; it is taken by seines and poundnets in large quantities; when caught it makes a croaking sound, also heard when the fish is at the bottom. The flesh is wholesome and well flavored, but so quickly gets soft that it does not rank high in the market. The air-bladder makes excellent isinglass for culinary purposes. The spotted weakfish (*C. nebulosus*) is conspicuously marked with round black spots above and the soft-dorsal fin is not scaly. It is more southern than the squeteague, and is sometimes called spotted trout. Other related species occur in West Indian waters and on the Pacific Coast.

WEALDEN, wēl'dĕn, certain delta-deposits of the Cretaceous (or Chalk system, from their great development in the weald of Sussex, England. Weald means in Old English a wood or forest, and the name is applied to a tract of country lying between the north and south downs of Kent and Sussex. The recognized geological name of this subdivision of the Cretaceous system is the Neocomian, from the old Latin name of Neuchâtel in Switzerland. This stage in the south of England, and thence eastward across Hanover, consists of a mass of sand and clay, sometimes 1,800 feet thick, representing the delta of a river. Only a portion of this delta remains, but as it extends in an eastern and western direction for a distance of at least 200, and from north to south less than 100 miles, its total area may have been 20,000 square miles, indicating a very large river flowing from a continent. The stream not improbably descended from the north or northwest. It carried down the drifted vegetation of the land, with occasional carcases of the iguanodons and other terrestrial or amphibious creatures of the time. Beyond the area overspread by the sand and mud of the delta, the ordinary marine sediments accumulated, with their characteristic organic remains. From Yorkshire, England, they stretch eastward through northwestern Germany, and are found at the base of the Cretaceous system through France into Switzerland. See GEOLOGY.

WEALTH. Wealth may be defined either as a state of being or as a category of goods. A state of wealth is practically identical with a state of well-being. It is a condition under which men possess most of the things they need. It is the opposite of a state of poverty. Wealth, however, is generally conceived as a category of goods. As a category of goods it includes all those material things which possess value or, which means the same thing, all those material things of which the community possesses less than it would like to have. Or again it consists of all those material things which the community thinks it worth while to strive to get in larger quantities than it already has.

From this point of view it will be seen that there is a very close connection between wealth as a category of goods and wealth as a state of being, though there is an apparent paradox here. Wealth is contrasted with free goods,— such as air, sunlight, beautiful scenery, abundant water and so forth. It is obvious that the more free goods the community possesses, the greater its well-being. If an object which is now considered as wealth could be made sufficiently abundant to satisfy all possible needs, the community would undoubtedly be better off, but that object would have ceased to be wealth. There would be one less article to include in the category of wealth.

This paradox, however, is only an apparent one. The object of wealth which, under the above illustration, has become a free good, has become such by reason of its abundance. Well-being is clearly improved by increasing its abundance. Now any material thing is wealth of which you can say that by increasing its abundance you would increase the well-being of the community. After it has become sufficiently abundant, you can no longer say that. If we have enough air, you cannot say that we would be better off if we had more. It is only when we have not enough that we can say that. Well-being, therefore, depends upon wealth in a very direct, immediate and practical sense. Anything of which we need more than we have is wealth. Anything of which you can say, — more of it, more well-being, less of it, less well-being,— is wealth. Anything of which you can say that it is worth our while to try to get more of it, is wealth; whereas anything of which you cannot say that, either because it is useless in itself or because we have already as much as we can possibly use, is not wealth.

Wealth as thus defined become an essential factor in the greatest and most practical of all the problems of man on earth: namely, that of adaptation. In some respects there is already perfect adaptation between man and his environment. In such cases there is no particular reason why he should think about or exercise his mind or body over the situation. There are many other cases, however, in which he does not find himself perfectly adapted. If the climate is too cold, he needs fuel, clothing and shelter. There is the best possible reason why

Resumé of Wealth of World.— The following table of national capital embraces the latest computations available before the breaking out of the Great War. It was coupled with an estimate of national and corporate indebtedness, represented by consols, rents, bonds and other "securities" amounting to $150,000,000, equal to 25 per cent compared with the aggregate capital of the countries represented.

CAPITAL OF THE COMMERCIAL WORLD, 1912.

COUNTRY	Population, millions	Wealth, millions dollars
United States, 1912, U. S. Census	96.9	187,000
Great Britain, 1909, computed	45.0	88,725
France, 1909, computed	40.1	83,000
Germany, 1909, computed	64.0	63,500
Russia, 1910, computed	146.8	60,000
Austria-Hungary, 1910, estimated	51.3	46,170
Italy, 1908, estimated	34.0	30,600
Spain, 1912, estimated	20.0	14,000
Turkey, 1910, estimated (Egypt and Tripoli excluded)	24.0	9,600
Belgium, 1907, estimated	7.3	10,950
Holland, 1909, estimated	6.0	9,000
Balkan States, 1910, estimated	14.0	7,000
Switzerland, 1910, estimated	3.5	3,030
Sweden, 1908, computed	5.4	2,197
Portugal, 1910, estimated	5.4	2,700
Denmark, 1906, estimated	2.6	2,340
Norway, 1910, estimated	2.4	1,440
Greece, 1907, estimated	2.6	1,300
North and South America, excluding the United States of America, est'd	70.3	34,448
Grand total	640.0	600,000

After the declaration of war, when new loans demanded more recent and thorough estimates of national resources, the wealth of Great Britain and her colonies and dependencies was computed at $110,000,000,000; France and her colonies, $90,000,000,000; Russia and her dependencies, $90,000,000,000; Italy and her colonies, $40,000,000,000; and the two German empires together, $150,000,000,000. This brought the grand total of national wealth in the states tabulated to about $707,000,000,000.

As a rule the computations which have been made of the wealth of nations are based upon tax returns. Taxes being usually levied upon productive resources, such computations, whether estimates of economists or returns of census marshals, embrace not the entire wealth, but rather the more effective capital or reproductive wealth of nations. Its rate of growth from time to time, therefore, affords inductions of a highly important and valuable character; such as the relation of money to capital, the dependable bases of taxation, the safe limits of debt, the financial significance of an impartial administration of justice and the probable future net rate of interest on permanent investments.

Relation of Wealth to Population.—Although this table is in effect the balance sheet of a nation, one that covers over a century of discovery, conquest, industry and savings, it does not on its face disclose the progress of individual wealth. Because, for example, it shows that in 1800 the wealth per capita was $200 and in 1912 $1,938, it does not follow that the average wealth has increased nine or 10 times. The dollar of 1800 and the dollar of 1912, though they may have contained substantially the same quantity of metal, were of widely different purchasing power; so different that it has even been doubted whether the average per capita wealth of to-day is much greater than it was a century ago. Not only has the number of dollars in circulation been enormously increased, their efficiency (velocity) in effecting exchanges has been enhanced by means of the check system, the transportation system and the post office.

In the year 1800, dollars, in order to effect distant exchanges, had to be transported by mounted messengers, mail-coaches or sailing vessels; now they are transmitted by railways, steamboats and telegraphs; formerly, even as to nearby exchanges, they were sent by hand; now they are paid by checks. For the most part only purchases over the counter are now settled with money. Another and opposite consideration must also be held in view. Formerly every family was obliged to keep a stock of provisions, raiment, arms and implements; and the valuation of these commodities helped to swell the returns of wealth made to the assessors. Such is now the superior organization of industry and trade that similar precautions are no longer necessary. The official returns now include little beyond real properties, their improvements and the stocks of producers, manufacturers and merchants; in short, taxable commodities. Any comparison of per capita wealth in dollars at one time with another which omits these considerations must, therefore, be fallacious.

But while the average individual wealth in tangible things may not have greatly increased, another sort of wealth has taken its place, which, though it cannot be computed in money, has enormously multiplied the national wealth and diffused it among individuals. This is the wealth of education, knowledge and skill.

Relation of Capital to Profit.— The earlier cadastres of the United States embrace continual accessions of territory, either by conquest from the Indians or purchase from France and Spain. For this and other reasons the summations of wealth do not afford a reliable guide to the average annual rate of profit in trade or investment. The doubling of national wealth from 1820 to 1840 is equal to about 3½ per cent compounded annually. The doubling from 1850 to 1860 is influenced by the accession of California and other territory in consequence of the war with Mexico; while that from 1860 to 1870 is complicated by the Civil War and an inflated currency. From 1870 to 1890 the returns indicate a profit on capital of about 4 per cent compounded annually; from 1880 to 1900 about 3½ per cent; and from 1890 to 1910 again about 3½ per cent, compounded annually. Even before the frequent repetition of 3½ per cent annual net profit at all normal periods, its identity with the net rate of interest for capital was gleaned from an analysis of the market rate of interest made in 1864. It is now widely recognized by economists, and as such it confers an additional value on the census returns and affords a useful guide to merchants, bankers and investors.

Relation of Capital to the Rate of Interest. — Temporarily and in any given market the rate of interest depends upon the local supply of money and credit; but in the long run and throughout any extensive country it depends upon the profits of production in agriculture, fisheries, mining, manufactures and the means of transportation; while these again depend

upon the rate at which the animals and plants increase and the minerals are produced under the hand of man. Other things being equal, were this rate to double, the net rate of interest (that is, the rate, divested of risk, taxes and the cost of superintending loans of capital) would tend to double; and contrariwise, were the rate of growth of the means of subsistence to diminish one-half, the rate of interest would tend to diminish one-half; for that would be all that capital could earn when invested in production. ('The Science of Money,' Chap. XIII).

Such being the case, it follows that the rate at which in the long run the capital of a nation increases (leaving out of view adventitious gains by discovery, invention or conquest, or, on the other hand, losses by war or other national calamity) affords a reliable indication of the prevailing rate of interest. Indeed, when stripped of all adventitious circumstances, the two things are seen to be essentially the same thing; the net rate of interest is itself the measure of national growth and vice-versa, the rate of national growth marks the net rate of interest.

International Comparison.— When the growth of capital in the United States is compared with that in other leading countries, the practical results of a liberal constitution, a common school system and the popular diffusion of education will be readily recognized. At the beginning of the 19th century Great Britain had a capital of $8,753,000,000; in the course of a century it increased eight times. France had a capital of about $11,000,000,000; in 100 years it increased about five times. According to an estimate from the data in Zimmermann's 'Survey' (London 1787), Germany, as now constituted, had a capital of about $10,000,000,000; in 100 years it increased about four and one-half times. The United States had a capital of about $1,000,000,000; and in the course of a century it has increased 88 times.

POPULATION AND CAPITAL IN THE YEAR 1800.

COUNTRY	Population	Wealth	Wealth, per capita
Great Britain.	16,000,000	$8,753,000,000	$547
France	27,000,000	11,000,000,000	409
Germany	20,000,000	10,000,000,000	500
United States.	5,300,000	1,072,000,000	202

Before the events which, preceding the European War of 1914, began to disturb the normal rate of progress in each country, Great Britain annually added to her national capital about 2½ per cent; France, 2⅛ per cent; and Germany less than 2 per cent. Meanwhile the United States was increasing (is still increasing) her national wealth to the extent of about 3½ per cent per annum. Were it regarded as a fair reward of superior industry, skill and invention, this rapid rate of progress in wealth would stand in no jeopardy of arrest. But in the fierce rivalry of international interests the palm of victory has not only to be won; it has to be defended.

National wealth cannot be deduced solely from either population, income, taxation, wages, the prices of commodities or the stock of money. In attempting to do this, many of the computations cited in Mulhall's 'Statistics,' Putnam's edition of Hayden's 'Dictionary of Dates' and other works of reference, have ended in the wildest misapprehension and confusion. In the absence of an official cadastre, the only reliable guide is the net rate of interest for capital, and even this must be employed with judgment. When either is ignored, the results can only be regarded as misleading.

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WEALTH OF NATIONS. "In the year 1776, Adam Smith published his 'Wealth of Nations'; which, looking at its ultimate results, is probably the most important book which has ever been written, and is certainly the most valuable contribution ever made by a single man toward establishing the principles on which government should be based." Henry Thomas Buckle thus described the significance of the work of the eminent leader of the English school of "Classical Economists." While the exponents of the now popular theory of extensive state activity would be inclined sharply to differ with Buckle's estimate of the importance of the 'Wealth of Nations' as an expression of political and economic philosophy, there can be no doubt that this work was more effective than any other in producing the generally accepted political theory which dominated the mid-Victorian England in which Buckle wrote his 'History of Civilization in England.' Whatever may be the opinion of the modern social reformer with respect to the validity of Smith's individualistic and *laissez-faire* political theory, it is undeniable that a work which was able to shape the political and economic thought of a great European country, as well as of a considerable portion of continental Europe, for more than half a century is worthy of serious consideration by any student of the evolution of economic and political theory. Inasmuch as Smith's major work involved a treatment of both political philosophy and economic theory, it may increase the clarity of this summary

children who are healthy, and cut their teeth early, weaning may begin earlier than with weak, sickly children. It should never be attempted during sickness, nor, unless absolutely necessary, in hot weather. It is best for both mother and child to bring it about gradually. By so doing the secretion of milk in the former is slowly diminished, and those complaints which arise from sudden weaning are prevented; while the child is gradually accustomed to other kinds of sustenance, and the restlessness and want of sleep, which are so troublesome in sudden weaning, are avoided. Both during the weaning and for some time after it no food should be given to the child except what is very easy of digestion, and more fluid than solid, and in particular what has no stimulating qualities, nor any that will tend to create acidity, or produce other marked changes in the organic function. See INFANCY.

WEARE, wâr, **Meshech**, American colonial leader: b. Hampton Falls, N. H., 16 June 1713; d. there, 14 Jan. 1786. He was graduated at Harvard in 1735; studied theology and entered the ministry, which he gave up for the practice of law; was repeatedly sent to the legislature, and in 1782 was speaker. His later appointments included that of commissioner to the Albany Congress (q.v.) in 1774, justice and (1777) chief justice of the Superior Court of Judicature. He was also colonel of a militia regiment, and when the Revolution opened was appointed chairman of the Committee of Public Safety. Upon the reorganization of the State judiciary he was placed at its head. He raised troops for defense against Burgoyne, whose invasion he materially aided in repelling. In 1776, under the temporary constitution, he was elected president of the State, and was annually re-elected until 1784. Under the new constitution he was again elected president, but resigned before the expiration of his term.

WEASEL (*Putorius noveboracensis*), a fur-bearing mammal (q.v.), typical of the family *Mustelidæ*. The body is elongated and slender, the head long, the legs short, the muzzle rounded and the tail short and slender. The feet have each five toes and are digitigrade and unwebbed. There are 34 teeth and the sectorial or flesh-tooth lacks an internal tubercle. The anal glands are developed and secrete a strong-smelling substance. The weasel attains a length of from 12 to 15 inches, of which the tail makes nearly one-third. The male is larger than the female. Above, the color is brown; below, white or pale yellow, the terminal one-third of the tail black. In winter the fur becomes more or less white, but this change is complete only in the north and does not affect the black of the tail; in this white phase the animal is called an ermine (q.v.). The common weasel, in one or other of its varieties, inhabits the entire eastern United States, westward to Minnesota, south to North Carolina and north to Canada; and is replaced in most other parts of North America by more or less closely related species and in Eurasia by others, of which the Siberian ermine is its nearest ally. Owing to its retiring and nocturnal habits it is unknown to most people. It is plentiful even in the vicinity of large cities, where it renders efficient service in the destruction of vermin.

The European weasel (*P. vulgaris*) is slightly smaller than its American relative, reddish brown in color, but whitish underneath. (See POLECAT). The weasel is a highly courageous animal, and makes war on rats, mice, hares and rabbits, birds and many other small animals. During the summer it devours insects, but appears never to partake of a vegetable diet. Instances are on record in which these animals have attacked horses and cows, and they sometimes exhibit an utter indifference to the proximity of man. They are especially fond of eggs, and rob hen-roosts and the nest of every wild bird which they find. Their mode of killing their prey is characteristic—since they usually fasten on to the neck of their victim, and hold firmly on while they suck the blood; next they eat the brains and only then the flesh. Like most of their near relatives they often kill much more than they require for food. They hunt by scent and are tireless in pursuit. Few animals are so active, and the slimness of their bodies enables them to explore every hole and hiding-place of their prey. Weasels live in holes under stone walls, rocks and trees, in burrows captured by force from ground-squirrels and woodchucks, in hollow stumps, etc. A nest of dried leaves and grasses is constructed and about five young are born in a litter. Consult Coues, 'Fur-bearing Animals' (Washington 1877); Merriam, 'Synopsis of the Weasels of North America' (Washington 1896).

WEATHER, the condition of the atmosphere, at any time in respect to heat, moisture, wind, rain, cloud and electricity; a change of weather implies a change in one or more of these elements. For the possibility and mode of making real predictions of the weather, see STORM; for the system of weather forecast, see METEOROLOGY.

The great changes of solar heating attending the alteration of day and night, and the annual march of the seasons, produce well-marked and predictable changes of weather in all parts of the world. There are indeed many tropical and sub-tropical regions of the earth where there is so much of regularity in several or all of the weather elements that the experience of preceding years forms a trustworthy guide by means of which the weather may usually be closely forecasted for a considerable time in advance. For example, the daily march of the barometric pressure at many tropical stations is so regular that the time of day can be told pretty closely by reading the barometer. But on the other hand, large irregular fluctuations of barometric pressure, rainfall and temperature prevail over a great portion of the earth, and in these regions there is as yet no sound system of local weather prediction for more than two days in advance.

The proximity of western Europe to the Atlantic makes it imposible in that region to predict the weather beyond a day or two at the utmost, except in the case of considerable storms leaving the American coast and likely, if not certain, to strike widely on the coast of Europe. In Norway and the Baltic, and places toward eastern Europe, the weather may be predicted for a longer time, owing to the more easterly situation. In America also, where storms advance chiefly from west to east, gales and unsettled weather are predicted for

places on the seaboard in the east some days before; though the course that a storm may take, whether more to the north or to the south, cannot be certainly foretold.

A forecast, conjectural indeed, yet often useful, may be made by observing the barometer, the winds and the face of the sky — especially the cirrus cloud, most elevated and delicate of the clouds; but some previous knowledge of the general features of storms (q.v.) is indispensable: these specially — (1) Storms have a circular area, and (2) advance in an easterly direction, bearing a low barometric pressure with them. (3) Winds blow from a high to a low barometer — the observer, standing with his back to the wind, having always the low barometer to his left in the northern hemisphere — and (4) with a force proportioned to the difference of the pressure, or to the steepness of the barometric gradient. (5) Storms are noticed first in the upper regions of the atmosphere, or in the region of the cirrus cloud. (6) In front of the storm the air is warm and humid; in the rear of it, cold, or cool and dry. With such observations, requiring only a barometer intelligently interpreted, particularly if hills form part of the landscape, the character of the weather may be foreseen for one day, or even on occasions longer. In general a falling barometer is not followed certainly by storm; but a rising barometer in bad weather indicates the passing away of the storm, though, in the colder season, possibly not without a change to higher winds and snow.

To the agriculturist and horticulturist, not high winds but hails, heavy rains, frosts and fine weather are what are required to be known. Such forecasts were begun in the United States by General Albert J. Myer; also in France by Leverrier shortly before his death; and they are gradually being introduced over the continent of Europe.

The weather prognostics of every language embrace much that is shrewd and of considerable value, but more that is vague and absurd. The changes of the moon long were, and in many minds still are, regarded as supplying the elements of prediction; but when brought to the test of accurate examination and figures, the supposed influence of the moon's changes on the coming weather is found to be a delusion. This was shown especially by an examination of 50 years' observations at Greenwich, and similar old records of the weather. For some years Thomas du Boulay predicted the general character of the weather of each summer from the weather conditions which prevailed during the week of the spring equinox preceding, supposing that the general character of the weather of the next six months is then settled, requiring only skillful reading. For a few years he speculated in grain on the faith of these predictions, which turned out correct on the whole; but later his predictions did not come true. Many persons forget that a great number of indiscriminately chosen instances are required for the verification of any theory of weather forecasting; and that more than half of these, when impartially considered, must be favorable to the soundness of the theory, else the result is attributable to chance alone.

Within the past few years progress has been made in two branches of experimental work, which may soon lead to marked advance in the line of forecasting. In the first place, the exploration of the upper air by means of kites and captive balloons carrying registering meteorological apparatus is yielding much knowledge of the distribution of atmospheric temperatures, currents and electrical conditions, which can hardly fail to promote the accuracy of storm forecasts.

In the second place, the work of the Smithsonian Astrophysical Observatory, begun under the direction of the late Secretary S. P. Langley, has tended strongly to show that the radiation of the sun (on which, directly or indirectly, all weather elements depend) is not constant, but varies often through a range of 10 or even 15 per cent in a few months. The connection between the temperature of the earth and the radiation it absorbs from the sun is such that a permanent decrease of 10 per cent in the latter would produce about 7° Centigrade (12½° F.) fall of the earth's mean temperature. But owing to the short period of the observed solar changes, and to the great capacity for heat of the oceans, the actual effect of the changes of solar radiation would generally be much less than this. Stations near the oceans will be only slightly affected, while stations in the interior of the great continents are apt to feel more nearly the full effect above estimated. On account of the secondary effects of changes of solar radiation upon cloudiness, and the reaction of cloudiness on temperature, the temperatures of different stations will be differently influenced. Owing to the immense size of the sun a considerable time must elapse before conditions affecting its radiation can reverse, and thus it seems highly probable that when the exact connection between the changes of solar radiation and the weather has been determined, it will be possible to predict the prevailing characteristics of a season, whether cold or hot, wet or dry, for some weeks, and perhaps one or two months in advance. See CLIMATE; METEOROLOGY; RAINFALL.

WEATHER BUREAU. The invention of the electric telegraph made it possible to apply the developing science of meteorology to the art of weather forecasting. While American scientists were pioneers in the development of the knowledge of the atmosphere, the United States was not the first government to organize a weather reporting service, but it was the first to do so on a large scale. Its broad expanse of territory permits it, with the aid of simultaneously taken observations at over 200 stations, to chart and study the operations often of several different storms at the same time, and to forecast their movements through two or three thousand miles of their progress eastward. Warnings of frosts, cold waves, floods, rain and snow storms, and of winds dangerous to mariners, are worth many millions annually, and the saving of human life is large. Forecasts cannot be made with mathematical accuracy, for they are practically all empirical deductions, but they do have such a high degree of verification that no one whose life or property is affected by the coming of severe storms would to-day consider for a moment doing without the benefit to be derived from them.

For many years the Smithsonian Institution

was the custodian of meteorological observations collected from government officials and others by mail, and Prof. Joseph Henry, Secretary of the Institution, in 1858, was the first person in this country (probably in the world) to collect by telegraph simultaneously taken weather observations and daily plot them on a publicly displayed map. Except in a tentative way, it does not appear that forecasts were made from these maps. He demonstrated, however, the feasibility of a national weather bureau, such as Dr. Increase A. Lapham, of Wisconsin, had diligently advocated for many years preceding, and such as Maury had suggested as the result of his studies of the storms of the oceans, and as Redfield had recommended in 1846.

Henry's map was discontinued with the breaking out of the Civil War, after having been in operation but a short time, as was a weather report issued by Prof. Cleveland Abbe, at Cincinnati, in the fall of 1869, with the aid of the Western Union Telegraph Company and the Cincinnati Board of Trade.

The persistent study of Lapham in taking comparative observations with Dr. Asa Horr, of Dubuque, Iowa, in 1853 and in 1860; the publishing of results in the *Milwaukee Sentinel* in 1861, showing, as Jefferson and Madison had done for Virginia many year before, that weather changes also progress from the west in the Mississippi Valley; his work in collecting and compiling records of the loss of life and property on the Great Lakes due to storms, and his petitions to scientific, commercial and legislative bodies, was mainly and immediately responsible for the resolution introduced in Congress by Gen. Halbert E. Paine, of Wisconsin, in 1870. This finally initiated a government weather forecasting system in the United States that has grown to be the largest of its kind in the world and more intimately to serve the people than does any other.

Gen. Albert J. Meyer, U. S. A., the first chief, a man of splendid executive attainments, so wisely laid the foundations of the new and unique service and so successfully demonstrated its value to the industries of the nation, that Congress readily gave the appropriations necessary for its growth and development. General Meyer at once called to his aid Dr. Lapham and Professor Abbe. Lapham did not wish to leave Wisconsin permanently, where he was considered one of the most useful citizens of the State, but he did service for a time at Chicago, where he made the first government weather map and issued to the public the first government forecasts, then called 'probabilities.' Professor Abbe accepted service and became a scientific aid to the chief in Washington, which position he held continuously until the day of his death in 1916.

Until 1891 the weather service was a part of the Signal Corps of the Army, and the chiefs were, in the order of service, Gen. Albert J. Meyer, Gen. Wm. B. Hazen and Gen. A. W. Greely. It then became a bureau in the Agricultural Department, with Prof. Mark W. Harrington chief. Harrington served four years, and was succeeded by Prof. Willis L. Moore, who directed its affairs for 18 years. The latter was followed by Prof. Charles F. Marvin, the present chief.

How a Weather Map is Made.—Each morning at eight o'clock, 75th meridian time—which, by the way, is about seven o'clock at Chicago, six o'clock at Denver, and five o'clock at San Francisco—the observers at 200 stations distributed throughout the United States and the West Indies take their observations, and, with the aid of carefully tested instruments, note the pressure of the air, the temperature, the humidity, the rainfall or snowfall, and the cloudiness. During the next 40 minutes these observations are speeding to their destinations, each station contributing its own observation, and important stations receiving in return such observations from other stations as they may require in the making of maps and forecasts.

At the Central Office in Washington as fast as the reports come from the wires they are passed to the Forecast Division, where a force of clerks is engaged in making representations of the geographical distribution of the different meteorological elements. One clerk constructs a chart showing changes in temperature during the past 24 hours. Broad red lines separate the colder from the warmer regions, and narrow red lines enclose the areas showing changes in temperature of more than 10°.

A second chart shows the changes that have occurred in the barometer during the past 24 hours. As in the construction of the temperature-change chart, broad lines of red separate the regions of rising barometer from the regions of falling barometer. Narrow lines enclose the regions where the change has been greater than one-tenth of an inch; inside of these lines other lines enclose the areas where the fall has been two-tenths, and so on. Here, for instance, throughout a great expanse of territory, all the barometers are rising—that is to say, that throughout this region the air is cooling and contracting, and therefore allowing that of adjacent warmer regions to flow in at high levels. Thus the total quantity of air resting on any given area at the ground is increased, and hence the barometers stand correspondingly higher. Over another considerable area the barometers are falling, as a result of the air above them flowing away to cooler regions. This chart indicates whether or not the storm centres are increasing or decreasing in intensity, and it gives, in a great measure, the first indications of the formation of storms.

A third chart shows the cloud areas, with the kind, amount and direction of clouds at each station.

A fourth chart, called the general weather chart, shows for each station the air temperature and pressure, the velocity and direction of the wind, the rain or snowfall since last report, and the amount of cloudiness. This is the principal chart from which the forecaster makes predictions. The readings of the barometer on this chart are reduced to sea-level, so that variations in pressure due to local altitudes may not mask and obscure those due to storm formation. Then lines, called isobars, are drawn through places having the same pressure. By drawing isobars for each difference of pressure of one-tenth of an inch the high- and the low-pressure areas are soon enclosed in their proper circles. The word "high" is written at the centre of the region of greatest air pressure,

and the word "low" at the centre of the region of least pressure. The air flows from a region of great pressure toward one of less, the velocity depending upon the difference in pressure in a given distance.

The arrows fly with the wind, and, as will be seen by reference to any weather map, are almost without exception moving indirectly toward the low or storm centre, and outward from the high.

A new weather map is made every 12 hours, and when severe cold waves, dangerous marine storms, heavy snows or floods are threatened, special reports are ordered to be sent to the Central Office every four hours from the danger region and some distance to the east of it. Through the frequent use of the telegraph and the telephone, and by maps and bulletins, the wireless and other agencies, every community in the United States is warned of impending weather changes that may be dangerous to it or harmful to its interests.

The work of the Central Office of the Weather Bureau is divided between several appropriate divisions, the chiefs of which direct their various branches under the supervision of the head of the whole service. The Forecast Division receives and charts the telegraphic reports that are sent in twice daily, and several times a day from restricted areas when dangerous conditions are imminent. It issues all the more important warnings for the whole country. To facilitate getting to the public the forecasts in the shortest possible time, district forecasters receive full sets of reports at Boston, Chicago, New Orleans, Denver, San Francisco and Portland, Ore., and simultaneously with the Central Office, make and distribute forecasts for definite districts, but these district centres are instructed from Washington with regard to each of the important warnings disseminated. Certain river centres issue forecasts of the daily stages of the rivers in their respective regions independent of the Central Office. Local forecasters at all of the important cities issue forecasts for their vicinities and have freedom of expression, provided they first receive from Washington forecast each for his State. In addition to the 200 regular observation stations of the bureau there are some 200 sub-stations at lake and sea ports that display flags during the day and lights at night to warn mariners of storms. Special means of distribution are provided so that warnings of frosts, cold waves, floods and marine storms may in each case reach all of those who may profit by them.

The River and Flood Division has charge of the work of that part of each local station that collects information as to precipitation and the amount of snow and ice on the ground throughout the water-sheds of the principal rivers, and the measuring of the height of streams. For this purpose, in addition to 48 full stations, where gauge readings are made, there are over 250 special stations that measure only the height of rivers and 74 that measure rainfall.

The duties of the Division of Agricultural Meteorology is to supervise the work of 3,000 voluntary or co-operating observers, who serve without pay and render reports of temperature, precipitation and other miscellaneous meteorological and climatic data, which are published in the *Monthly Weather Review*. There is thus being collected a large amount of data that is available for the discussion of climate in its relation to man from either a hygienic or a commercial viewpoint. During the seasons of planting, cultivating and harvesting, weekly reports of weather conditions and their effects upon various crops and farming operations are included in both the national Weekly Crop Bulletins and in 42 section bulletins. This division controls the distribution of the forecasts and warnings issued by the Forecast Division.

The Instrument Division is charged with the examination, testing, comparison, installation and maintenance of the instrumental equipment of the bureau.

The Division of Meteorological Records has charge of the compilation of meteorological and climatic statistics and their application to the various needs of commerce, courts of law and individuals.

The Division of Barometry and Aerial Exploration has charge of the exploration of the upper air by means of kites, balloons, theodolites and nephoscopes. It studies the technical problems of air pressure and vapor-tension.

There are also the Publications, Telegraph and Supplies divisions, the duties of which are indicated by their respective titles.

The observation instruments consist of standard wet, dry, maximum and minimum thermometers and the mercurial barometer, for measuring temperature and pressure, with wind vane and anemometer for wind direction and velocity. Most stations are also equipped with self-registering instruments that record continuously the fluctuations in pressure and temperature, velocity and direction of the wind and the number of hours of sunshine. An automatic raingauge also registers the time of beginning and ending of precipitation, together with the amounts that occur.

The telegraphic circuits are so arranged that at any station those reports are taken off that are used in making charts and forecasts at that station. The observation messages take precedence over all others and the efficiency of the telegraph companies is such that within an hour after the observations are taken they all have been received at Washington and other stations.

The press associations receive the forecasts as soon as made and immediately furnish them to the papers to whom they render service. They are also telegraphed to Chambers of Commerce, or delivered by messenger from the local office of the bureau to the commercial associations and marine agencies, where they are posted on bulletin boards. Before the more important commercial exchanges an observer of the bureau each morning draws the weather chart in different colored chalks, on a glass map of the United States of about 8 by 12 feet. The principal stations of the bureau are equipped with plants for the printing of the daily weather map and forecast cards, which are distributed by messenger and post. The forecasts are also telegraphed to a large number of postmasters, who stamp them on cards that are mailed to surrounding towns.

For a number of years the bureau maintained at Mount Weather, Va., a research

station, through the work of which the United States co-operated with other nations in the gaining of useful information of the great ocean of air above us. Up to 1912 the records of the world were broken at this institution, altitudes of four and one-half miles being attained with kites carrying self-recording instruments and balloons ascending to over 19 miles. The latter was accomplished by sending instruments and balloons to the far west, where they were liberated, the instruments descending to the earth farther east under parachutes after the balloons had burst. The exploration of the upper air made by this institution has proved of inestimable value to our aviators during the World War, an elaborate series of observations, or deductions thereupon, covering a period of five years, having been published by the National Advisory Committee for Aeronautics.

Further Development in Forecasting.—We reasonably may expect that it is but a matter of time and not far in the future, when enough of the observation stations of the bureau will be equipped with kites for windy days and aviators for days of moderate wind, so that there may be secured such a system of simultaneous observations as will enable the forecaster at Washington to construct a weather chart on say the three-mile level, which is about in the centre of storms, so far as their vertical dimensions are concerned. By comparing such a chart with the sea-level chart a much more accurate forecast surely can be made. At the close of the war many thousand air men were free for the development of mail, passenger and light freight transportation through the air. Then forecasts of the *stability* of the air for flight became imperative. The proposed high-level chart will render such forecasts possible. The time may be near at hand when Weather Bureau stations will display more warning signals from the tops of their office building and elsewhere for the benefit of air sailors than are now displayed to aid the sailors of the sea.

Ignorance of weather conditions on the oceans costs the world hundreds of millions of property annually and the toll of human life is appalling when expressed in figures. To aid in preventing this enormous loss, much of which is unneccessary if the full measure of the methods that science within recent time has put at our disposal is utilized, the writer, as chief of the Weather Bureau, organized a system of wireless observations from moving ships along the Atlantic and Gulf coasts that has enabled the forecaster to detect many hurricanes when they were entirely out of the range of our land stations and give full and timely warning of their approach. In 1912 he formulated and published a plan for the construction of a daily weather map of the Atlantic Ocean by the relay from ship to ship of simultaneous observations and their charting at the Central Office of the Weather Bureau in Washington. With only two-words in the message the location of the ship and the reading of the barometer can be conveyed. When the pressure of the air is plotted the direction and force of the wind will be known. The storm regions can be shown, and when hurricanes appear no ship carrying a receiving instrument need be unadvised of its location, for a high-power message can be flashed from some coast wireless station which will, at the same instant, reach every vessel on the great ocean.

The first thing necessary to the inauguration of the proposed great ocean service is the right of way for messages, so that they may be quickly accumulated at some central point. With the object of overcoming this difficulty the writer was made a member of the International Radio Congress that met in London in 1912, where, with the aid of the United States delegates, he secured the adoption of regulations that give to the observations needed in such a service the right of way over all messages except distress calls. The logic of events must eventually compel the creation of something so necessary to the needs of humanity, both on the Atlantic and the Pacific oceans. The return of our flag to the peaceful ways of ocean commerce and the protection of our fleet in time of war, would seem to require the proposed extension of the domain of the Weather Bureau.

Seasonal forecasts also seem to be one of the possibilities of the future. Abbot, Kimball and other able men are studying the variations in solar radiation, the recurrence and frequency of sun-spots and solar prominences, hoping by a comparison of data to trace some relation between them and the ever-varying seasons of the earth. Recent results are encouraging.

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WEATHER MAPS. See METEOROLOGY.

WEATHER SIGNALS. See SIGNALS AND SIGNALING.

WEATHERFORD, William, American half-breed Indian chief: b. Creek Settlement, Ala., about 1770; d. Monroe County, Ala., 1826. He was the son of a white trader and of a Seminole Indian woman. He was a warrior of great bravery and force of character; led the attack upon Fort Mims, 30 Aug. 1813; was defeated by Claiborne at the battle of Holy Ground, December 1813; and again suffered defeat at Horseshoe Bend, 27 March 1814, afterward surrendering to General Jackson. He subsequently retired to his plantation, where he lived peaceably the remainder of his life, respected and honored by both Indians and whites. Consult Parton, J., 'Life of Andrew Jackson' (Vol. I, 1860).

WEATHERFORD, weth'ẽr-fôrd, Tex., city, county-seat of Parker County, on a branch of Trinity River, and on the Gulf, Colorado and Santa Fé, the Weatherford, Mineral Wells and Northwestern and the Texas and Pacific railroads, 30 miles west of Fort Worth. It was settled in 1850 by persons from east Texas and the older States. In 1856 it was incorporated, and in 1858 chartered as a city. It is in an agricultural and stock-raising region; wheat, cotton and corn are among the principal productions. The chief manufactories are oil mills, cotton mills, a cotton compress, an ice factory, machine shops and the light plant. There are 10 churches. The educational institutions are the Texas Female Seminary (Cumberland Presbyterian), the Weatherford

below, with the entrance at the bottom or at the side. They are very generally suspended at the extremities of branches, and often over water, probably as affording security against monkeys, snakes and other enemies. The Mahali weaver (*P. taha*) is said to insert thorns into its nest, as a further protection against marauders. A Philippine species (*P. Philippinus*) builds flask-shaped nests of fine roots suspended mouth downward by long ropes of similar construction from the boughs of trees. Consult Bartlett, 'Monograph of the Weaver-birds' (Maidstone 1888).

WEAVERS, The. The misery of the Silesian weavers of the second quarter of the 19th century inspired Heine to one of his most moving ballads and is a matter of common historical knowledge. Gerhart Hauptmann derived his intimate feeling for it chiefly from the lips of his grandfather, one of the actual sufferers; and in his work 'Die Weber' ("The Weavers") (1892) he has given to industrial revolution a stronger sanction than can be found in any other dramatic work whatever. 'Die Weber' is rather a series of five one-act dramas than a drama in five acts. Different groups of persons appear in five different places. But the persons belong to the same community, they pass to and fro, and the five acts, each a unit, with skilful exposition and a theatrical conclusion, constitute a greater whole, in which rebellion is carried to temporary success, but which is mainly impressive for the presentation of conditions that cry out for a remedy. There is no hero; every person is an integral character, every one a reality, and to the tragedy of starvation as the only reward for toil is added the pathos of vicarious atonement: an old weaver who refuses to leave his loom in order to join his fellows in rebellion is shot by a stray bullet. Hauptmann's method is unqualifiedly naturalistic. The play was first written in the harsh Silesian dialect, and the revised form in general circulation is only approximated to the literary language. It smacks of the soil. Its power resides in its apparent artlessness, in the impressiveness of truth naked and unadorned. There is, however, in a treatment of squalor which arouses unmixed sympathy a high degree of art, as there is also a preachment the more eloquent for being left to be inferred. Its text is the simple precept, give them their daily bread. Consult 'The Dramatic Works of Gerhart Hauptmann' (tr. by Ludwig Lewisohn and others, New York 1913–15).

WILLIAM G. HOWARD.

WEAVING, a process in which a series of longitudinal strands of fibre of one kind or another are united into a web or fabric by interlacing with cross threads. The two sets of threads employed traverse the web at right angles to each other. The first set extends from end to end of the web in parallel lines, and is commonly called the warp; while the other set of threads crosses and interlaces with the warp from side to side of the web, and is generally called the weft or woof. In all forms of weaving the warp threads are first set up in a device known as a loom, and then the weft threads are worked into the warp, to and fro, by means of a shuttle.

The art of weaving is of such extreme antiquity that its beginnings cannot be traced; and, indeed, the idea seems to have had a well-nigh universal origin in the human mind, as the essential methods are found in well-developed form among savage tribes which have never been in touch with civilization. The primitive loom may have been no more than a simple beam suspended from the branch of a tree and sustaining the warp fibres or threads, the weft being worked in by hand with a sort of needle. But from the earliest days down to the present it has been by this fundamental process of interlacing two sets of thread in looms of simple mechanism that all known textile fabrics have been produced — the mummy cloths of Egypt, the fine damasks and tapestries of the Greeks and Romans, the Indian muslins, the shawls of Cashmere, and the world-famed weaves of Italy and the Netherlands.

Four classes of woven cloths are recognized by weavers: (1) Single, or simple cloths, in which there is but one warp and one weft interlaced at right angles to one another; (2) Compound cloths, in which there are two or more warps or wefts interlaced at right angles; (3) Cloths in which the warp threads either singly or in groups are interwoven with each other during the weaving, with a knitting stitch; (4) The pile fabrics of all degrees. The first class includes all ordinary cloths of single thickness. The second class includes what are known as "backed" cloths, two-ply, three-ply and four-ply fabrics, tapestries and padded fabrics. The third class includes all fabrics of the gauze type, or which are partly in the "leno" or knitting stitch. The fourth group includes such fabrics as Turkish towels, Brussels carpets, velvet carpets, plushes and velvets of all descriptions.

The instrument or mechanism by which the operations of weaving are accomplished is known as the loom (q.v.). Looms are classified as Hand Looms and Power Looms, according to the motive power employed. In the hand loom the operator throws the shuttle with his hand, and works the treadles with his feet. The power loom is automatic, all necessary motions being carried out by ingenious and often intricate mechanisms, so that once started it continues weaving until all the warp has been made into cloth. An attendant stands by in case of accident, and usually one operator can attend to several running looms.

Hand Looms.— Until comparatively modern times all weaving was effected by means of the hand loom. This loom, in its usual form, consists of a frame of four upright posts braced together by cross-beams, a centre horizontal beam at the back being the warp beam, the beam in front being that upon which the web is wound, while just below this, in front, is the breast-beam for the support of the weaver at his work. At the top of the loom is an apparatus by which the heddles are lifted or lowered by means of treadles under the foot of the weaver. These heddles consist of vertical frames, set with cords, each with an eyelet at the centre. In "setting" the loom the mass of threads constituting the warp is wound upon the warp-beam as upon a spool. They are then led one by one to the heddles. If there are but two heddles on the loom, as in plain weaving, the

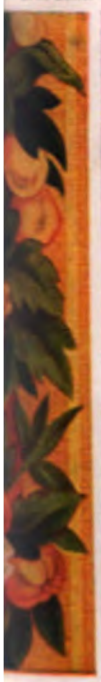
Italian Silk Fabric of 13th Cent.

Velvet Patterns. 15th Cent.

Burgundy Velvet. 16th Cent.

Silk Fabric. 17th Cent.

Silk Fabric. 17th. Cent.



Persian Carpet.

Old Arabian Pattern.

Indian Cotton Carpet.

Border of a Cashmere Shawl.

Chinese Silk Fabric.

threads are passed alternately through the eyelets; that is, the first, third, fifth — and all the other odd-numbered threads through one heddle, and the even-numbered threads through the other. A loom may have many heddles, as in pattern weaving and in that case the threading of the warp through the heddles requires much

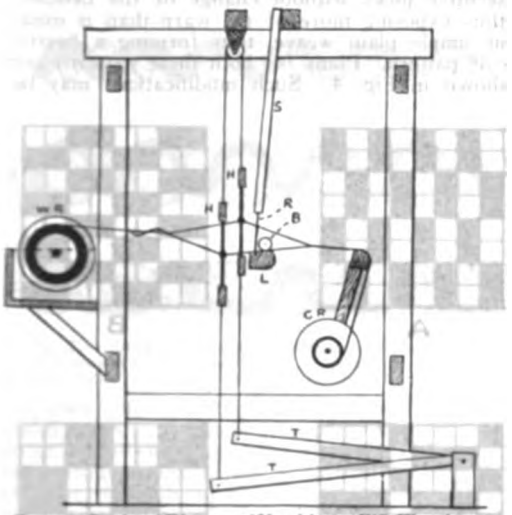


FIG. 1.—Sectional Diagram of Hand-loom. *WR*, Warp beam; *CR*, Cloth beam; *H*, *H*, Heddles; *T*, *T*, Treadles; *L*, Ley; *R*, Reed; *B*, Bobbin; *S*, Swords.

skill, to be gained only by experience. After passing the heddles the threads are brought forward through the reed, a sort of comb-like structure with long teeth, lying upon its back, the teeth extending vertically upward. Two adjoining warp threads pass in the space between each two teeth of the "comb." The ends of the warp are finally fastened to the cloth-beam in front. Care is needed in order that all the threads shall have equal tension, so that the cloth when woven shall be smooth, and not pucker. Attached to the lower edge of the reed is the "ley" or "sley" which serves to weight the reed and thus give force to its blow in the weaving process, and also provides a shelf along which the shuttle travels. See Fig. 1.

In the operation of the loom, when one heddle is raised every second thread in the warp is also raised, while the remaining threads are depressed; and this is called shedding the warp. When the warp threads are thus parted there is left a small opening or shed between the threads directly in front of the reed, and it is through this opening that the weaver drives his shuttle to and fro, from side to side. The shuttle, which is hollow in the middle, contains the weft-thread wound around a bobbin or pirn, and as the shuttle is shot across the web this weft-thread unwinds itself. When the thread is thus introduced it is necessary to bring it to its place in the fabric. This is accomplished by means of the ley or batten, suspended from a pivot at the top of the loom, swinging backward and forward like a pendulum by an attachment of vertical rods at each side called the swords. The teeth of the reed are thus swung forcibly against the newly laid weft thread, driving it solidly to its place in the cloth. The other treadle is then pressed down, raising the other heddle and, with it, the alternate warp threads, thus forming another shed, in which the threads which were the floor of the first shed are the roof of the second. Through this new shed the shuttle is thrown on its return journey. This throwing of the shuttle is termed "picking" and each traverse of the web is called a "pick." The travel of the shuttle is accomplished by means of a Y-shaped handle, to the arms of which are attached two strings which lead one to each of the shuttle boxes at the ends of the ley. A quick jerk upon the string sends the shuttle flying out of its box through the shed of warp threads and into the shuttle box at the opposite end of the ley. Thus the weaving proceeds, the ley being swung forward, driving up the new weft thread, after each pick of the shuttle. Occasionally, as the web of finished cloth increases, the loom is stopped, and the cloth is wound up around the cloth-beam, another stretch of warp being unwound from the warp-beam; and this succession of operations continues until the entire length of the warp has been woven into cloth.

Weaves.—There are three fundamental methods or plans of interlacing the warp and weft threads in weaving; (1) plain weave; (2) twill weave; and (3) sateen, or satin weave. All woven cloths may be referred to one or another of these three primary plans or of a combination of two or more of them — in which case the texture is called "combination weave." By far the larger part of all woven fabrics is produced by the plain weave method, but these cloths are varied in many ways — by modifications of the relative sizes of the warp and weft threads, by manipulations of the heddles, and to an unlimited degree as to the color and design by the use of self-colored and parti-colored threads in both weft and warp.

Plain Weave.—In plain weave the threads are made to interlace alternately; and, if the warp and weft threads are of the same diameter, and there are an equal number of each to the inch, they bend around one another to about the same degree, and thus form a plain flat uniform cloth, in which the warp and weft threads

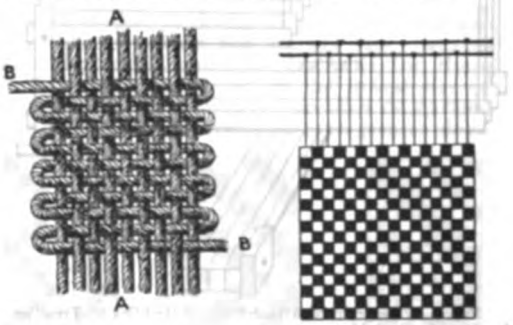


FIG. 2.—Simple Weave, showing the interlacing of the warp threads *A*, *A*, with the weft thread *B*, *B*. At right the weaver's pattern for simple weave with the tie-up of the two heddles employed (above).

appear equally on the surface. With this weave are produced the finest cambrics and muslins, and the heaviest woolen blankets — and the numberless other fabrics of similar texture lying between these two extremes.

A diagram of the interlacing of plain weave fabrics is shown in Fig. 2, the threads A,

A representing a section of the warp, and the continuous cross-thread B, B representing the weft. In actual weaving the warp threads would lie close together, usually from 16 to 64 to the inch, and each pick of the weft would be driven up snugly to the one preceding by a blow of the reed. In order that the weaver may know what style of cloth he is to produce, a plan or pattern is drawn for him by the designer on paper ruled in squares; the latter being marked in some way to indicate the position the thread represented will occupy in the finished cloth. The rows of squares running vertically indicate the warp, and those horizontally the weft. As only the warp threads are raised and lowered by the heddles, the pattern is made to indicate these movements by coloring the squares.

Ordinarily (though the exact reverse is sometimes encountered), a blackened square shows that that section of the warp is depressed below the weft thread on that pick. It is also customary to show the threading of the heddles above (or below) the pattern — as shown in the figure. The two heavy horizontal lines indicate the bars of the two heddles used in plain weaving; the upright lines leading to the heddle bars from the pattern indicate the method of threading each strand of the warp.

Fig. 3 shows a diagram of the arrangement

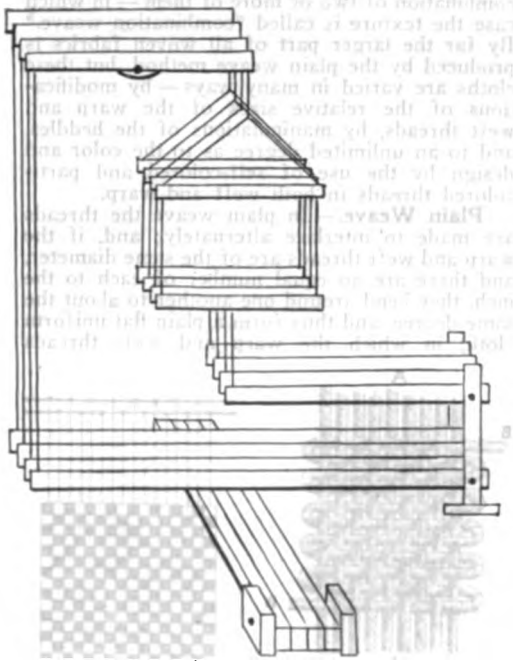


FIG. 3.— Diagram of Attachment of Heddles to Treadles for Double Shed Motion.

of levers where both the rising and sinking of the warp threads are employed in producing the shed. The short horizontal levers are so tied to the long ones that when one of the latter is depressed by stepping upon a treadle, thus raising one of the heddles, all of the other heddles (three in this case) are pulled down, producing the double movement shed shown in profile in Fig. 1.

Modifications of the plain weave may be made in several ways; for example, by taking in two or more threads of the warp with each pick of the weft, thus extending the exposure of the weft from side to side, or as this form of pattern is designated, in the "horizontal" form. Or two or more threads of the warp may be passed under by the weft in consecutive picks without change of the heddles, thus exposing more of the warp than is usual in simple plain weave, thus forming a "vertical" pattern. Plans for both these patterns are shown in Fig. 4. Such modifications may be

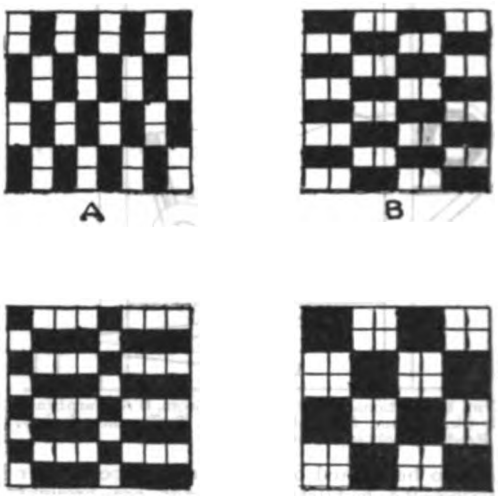


FIG. 4.— Plain Weaves. *A*, Vertical pattern; *B*, Horizontal pattern; *C*, Horizontal 1-and-3 pattern; *D*, Basket Weave.

uniform, or they may be uneven in design, that is, the same number of threads may be taken in at each stitch, or there may be a constant variation, as 1-and-3, 1-and-3, and so on. If the same number (more than one) are taken both vertically and horizontally the "basket-weave" is produced. Plans for these also are shown in Fig. 4.

Twill Weave.— In the weaving of twills the interlacing is quite different from plain weave. Considering the shuttle as starting from the left hand, and the threads numbered consecutively from left to right, the operation may be described thus: for the first pick the first thread of the warp is raised, allowing the shuttle to pass under it, the second and third threads being depressed so that the weft lies above them; the fourth thread is raised and the fifth and sixth are depressed — and so on. On the second pick, that is, as the shuttle comes back to its first position, the heddles are operated so that the second thread of the warp is raised, the third and fourth being depressed; the fifth raised, and the sixth and seventh depressed — and so on. As the shuttle starts away again from the left, the first and second threads are depressed and the third raised; the fourth and fifth depressed and the sixth raised — and so on; this completing the cycle. By this method of manipulating the heddles is produced the diagonally ribbed appearance of the surface of the cloth characteristic of twills. These rib-

known as "herring-bone" or diaper — as shown in Fig. 9. In Fig. 10 is shown an elaborate pattern of twill which may be worked on 10 heddles and with 10 treadles. One of the chief advantages of the twill pattern is that a firm and substantial cloth may be thus woven from comparatively light yarns.

Sateen Weave.— In sateen weaving at least five heddles are used. Supposing the shuttle to start from the left side of the warp, and the warp threads to be numbered consecutively from that side, the operation may be described as follows: the first, sixth, 11th, etc., threads are stitched on the first pick; the third, eighth, 13th, etc., on the second pick; the fifth, 10th, 15th, etc., on the third pick; the second, seventh, 12th, etc., on the fourth pick; and the fourth, ninth, 14th, etc., on the fifth pick — thus completing the sateen cycle. The resulting fabric is of peculiarly pleasing texture, displaying comparatively long stretches of parallel fibres, affording a smooth and silky texture.

On five threads and five picks only two patterns of regular sateens are possible. These are indicated at A and B in Fig. 11. Variations are produced by increasing the number of threads or picks in each stitch; thus producing patterns C and D in the same figure. Further variations give patterns E, F and G. It is readily seen that no regular sateen pattern can be worked out on six threads (each way). With seven threads, however, there are four; expressible by the leaps in the stitches, thus: 2-and-5, 3-and-4, 4-and-3, and 5-and-2. In an eight-thread design there can be only two sateens: 3-and-5 and 5-and-3. In an 11-thread design eight different sateens are possible: 2-and-9, 3-and-8, 4-and-7, 5-and-6, 6-and-5, 7-and-4, 8-and-3, 9-and-2. As a practical limit in designing it may be mentioned that 24-thread patterns are in use for fine silks, though rarely for other materials.

Damasks.— In damask weaving the pattern is produced by arranging that the warp in some parts of the fabric and the weft in others shall be exposed in more or less solid masses. This form of weaving is employed more generally in textiles of cotton, linen and silk, though sometimes in woolen dress goods. Well-known examples are table linen and upholstery. The stitch is usually of five-thread or eight-thread sateen. In some of the finer napery the ground work is in five-thread sateen and the figure in eight-thread sateen. These fine fabrics may show up to 140 threads of warp and 200 picks of weft to the square inch. An illustration of damask texture is shown in Fig. 12.

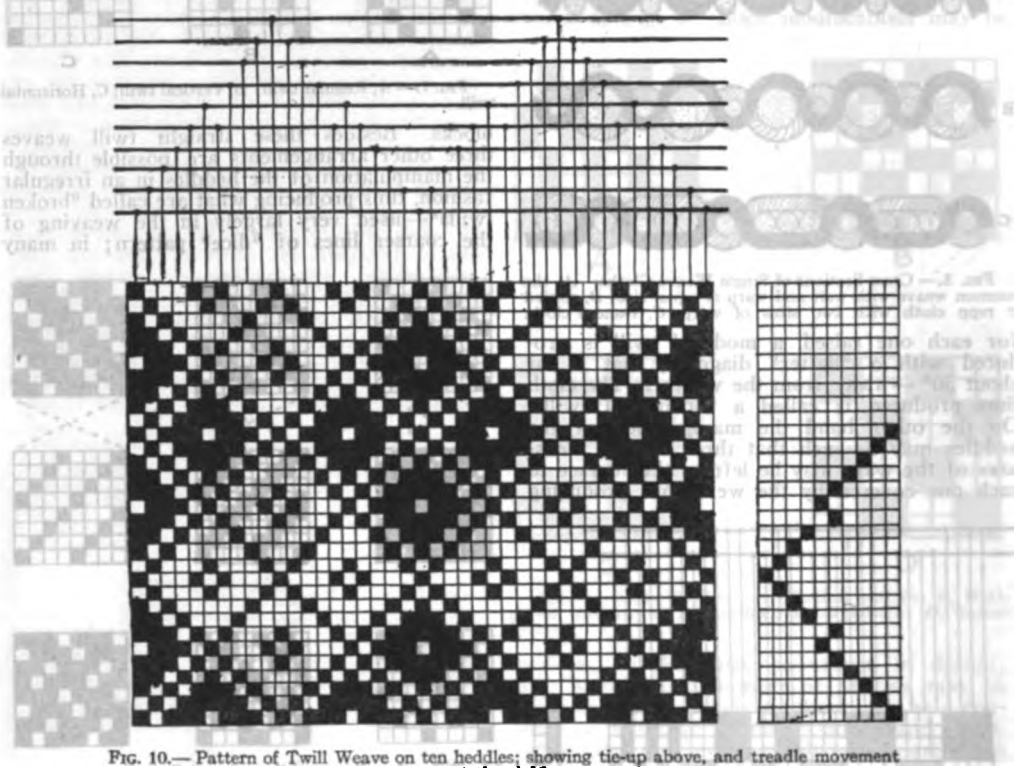


FIG. 10.— Pattern of Twill Weave on ten heddles; showing tie-up above, and treadle movement at the right.

The possibility of combining the fundamental weaves in the production of "combination-weave" textures has been referred to already. The necessary limits of an article such as this preclude a discussioin of these numberless variations, and the student must be referred to the technical works cited in the bibliography at the close of the article.

Jacquard Loom.— A most important improvement was made on the handloom by Joseph Jacquard of Lyons, who, in 1801, invented an apparatus by which the most intricate patterns

two sets of warp threads from two warp beams, and interweaving the two at intervals so as to form a double cloth. Kidderminster or Scotch carpeting is the chief example of this process. Three-ply and four-ply cloths are similarly made. The plan of make-up of these fabrics is illustrated in Fig. 14.

FIG. 14.— Sectional Diagram of one of the many methods of weaving double cloth on two sets of warp.

Pile Weaving is the process by which fabrics like that of velvets, velveteens, corduroy and Brussels carpets are produced. In the weaving of these fabrics, besides the ordinary warp and weft, there is what is called the pile-warp, the threads of which are left standing in loops above the general surface until cut, and the cutting of which produces the pile. In such fabrics as Brussels carpet the loops are left uncut. The manner in which the pile-warp is woven into the fabrics is illustrated in Fig. 15. See LOOM; VELVET.

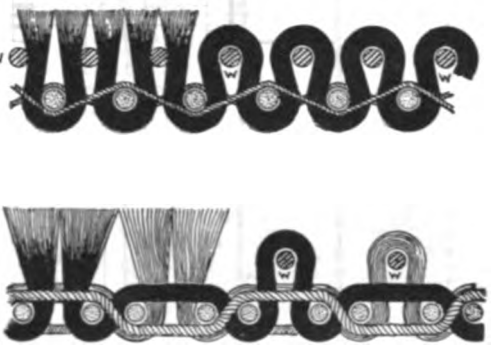


FIG. 15.— Sectional diagrams of two of the principal methods employed in the weaving of pile fabrics; showing both cut and uncut loops. *W*, *W*, wires on which the loops are formed.

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RICHARD FERRIS.

WEBB, Alexander Stewart, American soldier and educator: b. New York, 15 Feb. 1835; d. 12 Feb. 1911. He was graduated from West Point in 1855, was assistant professor of mathematics there in 1857-61, and at the outbreak of the Civil War became major of the First Rhode Island infantry. He participated in the defense of Fort Pickens, was at the first battle of Bull Run, served in the Peninsular campaign and in 1863 became brigadier-general of volunteers. At Gettysburg he assisted in repulsing Pickett's charge and received a Congressional medal of honor in recognition of his gallantry. He was engaged in the Rapidan and the Wilderness campaigns, was wounded at Spottsylvania and upon his return to duty was appointed chief-of-staff to General Meade. He received brevet rank as major-general of volunteers in 1864 and was brevetted brigadier-general of regulars in 1865. In 1866 he was promoted lieutenant-colonel, was brevetted major-general in the regular army in 1869 and in 1870 at his own request received an honorable discharge. He was president of the College of the City of New York in 1869–1903 and wrote 'The Peninsula: McClellan's Campaign of 1862' (1882).

WEBB, Aston, English architect: b. London, 22 May 1849. He was educated in private schools, was articled to Banks and Barry, architects, and began practice in 1873. He was the architect for the completion of the Victoria and Albert Museum and the Royal College of Science, South Kensington; the Britannia Naval College, Dartmouth, and the achitectural accessories for the Victoria Memorial before Buckingham Palace. He has designed many churches, commercial structures and mansions, and, with E. I. Bell, the Victoria Courts, Birmingham; the Birmingham University and the new schools of Christ's Hospital. He was president of the Architectural Association in 1884 and vice-president of the Royal Institute of British Architects 1893–97. He was knighted in 1904 and given the K. C. V. O. in 1914.

WEBB, Beatrice Potter, English economist: b. England, 22 Jan. 1858. She was educated privately and later engaged in investigation of social conditions. In 1892 she was married to Sidney Webb (q.v.), with whom she has collaborated in the preparation of several works on economics. She served on the Royal Commission on Poor Law and Unemployment in 1905–09 and was joint author of the minority report. From 1909 she was honorary secretary of the National Committee for the Prevention of Destitution. She is prominent in the Fabian Society. She edited 'The Case for the Factory Acts' (1901), and is author of 'The Co-operative Movement in England' (1891; new ed., 1904).

WEBB, Charles Henry (pen name "JOHN PAUL"), American journalist and humorist: b. Rouse's Point, N. Y., 24 Jan. 1834; d. New York City, 24 May 1905. He was on the staff of the New York *Times* (1860–63), and going to California in 1863 founded the *Californian*, San Francisco, which he edited till 1866. Subsequently he contributed to the New York *Tribune* humorous articles signed "Jean Paul." He invented an adding machine, but was better known by his burlesque dramas, among which are 'Liffith Lank' (1867) and 'Saint Twel' Mo' (1868). Other works by him are 'John Paul's Book' (1874); 'Parodies, Prose and Verse' (1876); 'Vagrom Verse' (1889); 'More Vagrom Verse' (1901).

WEBB, James Watson, American journalist and author: b. Claverack, N. Y., 8 Feb. 1802;

d. New York, 7 June 1884. He entered the United States army as second lieutenant and became adjutant in 1825; served in the West under General Scott, and resigned from the army in 1827. In that year he became editor of the *Morning Courier* in New York; this was united with the *Enquirer* as the *Courier and Enquirer*, which he edited until 1861, when it was merged in the New York *World*. At first he supported Jackson but later as vigorously opposed Jackson's measures, and made the *Courier and Enquirer* one of the leading Whig papers. In 1851 he was appointed engineer-in-chief of New York State and given the rank of major-general. After refusing an appointment as Minister to Turkey, he was appointed Minister to Brazil in 1861, which office he held until 1869. In 1865 when he was in France for a time, he negotiated a secret treaty with the emperor providing for the removal of the French troops from Mexico. He wrote 'Altowan, or Incidents of Life and Adventure in the Rocky Mountains' (1846); 'Slavery and its Tendencies' (1856), and 'National Currency' (1875).

WEBB, Samuel Blatchley, American soldier: b. Wethersfield, Conn., 15 Dec. 1753; d. Claverack, N. Y., 3 Dec. 1807. He joined the Revolutionary army immediately after the battle of Lexington, was engaged at Bunker Hill, became aide to General Putnam and in June 1776 was appointed private secretary and aide-de-camp to Washington, receiving rank as lieutenant-colonel. He was engaged at the battles of Long Island, White Plains, Trenton and Princeton, and in 1777 took command of the Third Connecticut regiment which he had organized, equipping it almost entirely from his own funds. He accompanied General Parsons' expedition to Long Island in 1777 and on 10 December was captured with his command. He remained a prisoner until 1780, when he was appointed to succeed Baron Steuben in command of the light infantry, with brevet rank of brigadier-general. He was one of the 16 founders of the Society of the Cincinnati in 1783, and in 1789 held the Bible, on which Washington took the oath as first President of the United States.

WEBB, Sidney, English political economist and Fabian socialist: b. London, 13 July 1859. He was educated in Switzerland and at the City of London College, and in 1878 entered the civil service, holding several different positions, chiefly in the colonial office, and resigning from the service in 1891. He was admitted to the bar in 1885. He was one of the founders of the Fabian Society (q.v.), and in 1891 was elected to the London County Council as a candidate endorsed by the Fabian Socialists. He is lecturer on political economy at the London School of Economics and Political Science and is a member of the Economic Faculty of London University. He has written 'Socialism in England' (1890); 'The Eight Hours' Day' (1891, with Harold Cox); 'The London Programme' (1892); 'Labor in the Longest Reign' (1897), and in collaboration with his wife, Beatrice Potter Webb, 'The History of Trade Unionism' (1894); 'Industrial Democracy' (1897); 'Problems of Modern Industry' (1898); 'English Local Government' (1906); 'English Poor Law Policy' (1910); 'The Prevention of Destitution' (1911), etc. 'The History of Trade Unionism' is an exhaustive account of the origin and progress of the English labor unions; 'Industrial Democracy' shows the organization and ideals of the modern British trades unions. These two works form perhaps the most valuable contribution to the history of English labor, and written with sympathy and forcible directness, well express the power and vitality of the labor movement.

WEBB, Thomas, British soldier and Methodist pioneer in America: b. England, 1724; d. Bristol, England, 20 Dec. 1796. He was an officer of the Royal American army and saw service at Braddock's Defeat in 1755; at the storming of Louisburg, Nova Scotia, in 1758 and with Wolfe at the battle of the Heights of Abraham in 1759. He was converted to Methodism by the preaching of John Wesley at Bristol, England, and was afterward licensed to preach. He returned to America on military duty and after 1767 preached in New York in alternation with Philip Embury. He was the largest contributor to the fund for the erection of the John Street Church, New York. After his retirement from the army with rank of captain he devoted himself to the preaching of Methodism. He founded the first Methodist society at Philadelphia and also established societies in New Jersey, Delaware and Maryland, as well as holding services at his home in Jamaica, L. I. He twice revisited England to solicit funds and preachers for the Church in America. After the outbreak of the Revolution he returned to England and spent the remainder of his life as a preacher at Bristol.

WEBB, William Henry, American shipbuilder: b. New York, 19 June 1816; d. 30 Oct. 1890. He was educated in the grammar school of Columbia College, New York; learned the trade of shipbuilding in his father's yard; became manager of his father's business in 1843. Under Webb's management were built many ships of war for the United States and foreign governments, as the *General Admiral*, steam-frigate for Russia, two steam-frigates for Italy, the *Dunderberg*, iron-clad ram for the United States government. In 1890 were erected buildings at Fordham, N. Y., for an "academy and home for shipbuilders," founded by Webb. The objects of the academy and home are: 1. Relief of "aged, indigent and unfortunate men" who have been engaged in any department of shipbuilding in the United States; relief also of their widows. 2. Providing for American young men of good character gratuitous education in the profession of shipbuilding and machine-engine building, together with free maintenance.

WEBB CITY, Mo., city in Jasper County, on the Kansas City Southern, the Saint Louis and San Francisco and the Missouri Pacific railroads, about eight miles east of Joplin, and known with its neighbor, Cartersville, as one of the "Twin Cities." It was first incorporated in 1876, three years after the discovery of extensive deposits of lead ore, zinc being discovered several years later, and in 1890 became a city, its government being administered by a mayor and a council of 10 members. It is important as a mining town, the Webb City-Cartersville mining district having very extensive deposits. It is the centre of a rich agri-

cultural and fruit-growing section. The Webb City Iron Works are the second largest in southwestern Missouri, and the city has also lumber and flour mills. It has 12 churches, five graded elementary schools and a high school. Webb City is the seat of the Great Western Normal School and Business College. The waterworks system cost originally $100,000. It has two banks and two daily newspapers. Pop. 18,000.

WEBB-KENYON LAW, a regulation in regard to liquor traffic, declared constitutional by the United States Supreme Court 8 Jan. 1917. By this law, shipment of liquor from "wet" to "dry" States is prohibited. This decision also rendered constitutional the West Virginia law prohibiting the importation of intoxicants for personal use. By this means, a long controversy on the subject was ended and the enforcement of prohibition in dry States greatly enhanced.

WEBB-PEPLOE, Hanmer William, clergyman of the Church of England: b. 1 Oct. 1837 at Weobley. He was educated at Marlborough College, Cheltenham College and Pembroke College, Cambridge. In 1863 he was ordained deacon and priest; became curate of Weobley and served for four years. At the same time he was chaplain of Weobley Union until 1876, vicar of Kings Pym Cum Birley 1866–76 and of Saint Paul's, Onslow Square since 1876, prebendary of Saint Paul's Cathedral since 1893. In college he was a champion athlete and was seriously injured. As a result he was confined to his bed for three years and continued his college work on his back. He was Cambridge University preacher in 1896. Has been much interested in missions and connected with several missionary organizations. He is the author of 'I Follow After' (1894); 'All One: Sermons' (1896); 'Life of Privilege' (1896); 'Victorious Life' (1896); 'Calls to Holiness' (1900); 'Within and Without' (1900); 'Titles of Jehovah' (1901); 'Four Remarkable Letters of Saint Paul' (1903); 'He Cometh' (1905); 'Consider Him; or, Sketches of the Four Gospels' (1906); 'The Beautiful Name' (1910).

WEBBER, wĕb'ẽr, **Charles Wilkins,** American author: b. Russellville, Ky., 29 May 1819; d. Nicaragua, 11 April 1856. In early youth he passed several years of adventurous life on the Texan frontier and later settled in New York where he was for a short time assistant editor of the *American Review* and a prolific contributor to that and the *Democratic Review* and other periodicals, in which appeared in a serial form his 'Old Hicks the Guide' and other tales of backwoods life and adventure. In 1849 he published the 'Gold Mines of the Gila.' His remaining works comprise the 'Hunter Naturalist' (1851); 'Spiritual Vampirism' (1853); 'Tales of the Southern Border' (1853), and 'Wild Scenes and Song Birds' (1854), forming a second volume of the 'Hunter Naturalist.' In 1856 he joined an expedition to Nicaragua in aid of William Walker (q.v.) and was killed in a skirmish.

WEBBER, Herbert John, American plant physiologist: b. Lawton, Mich., 27 Dec. 1865. He was graduated at the University of Nebraska in 1889 and took his Ph.D. at the University of Washington in 1901. He was in charge of the United States Department of Agriculture's plant-breeding investigations in 1889–1907, and investigated orange diseases in Florida in 1893–97. He served as professor of experimental plant biology at Cornell University in 1907–08; was acting director of plant breeding there in 1909–10, and was professor of plant breeding at the New York College of Agriculture in 1910–12. Since 1912 he has been director of the Citrus Experiment Station, dean of the Graduate School of Tropical Culture and professor of plant breeding at the University of California.

WEBBER, Samuel, American college president: b. Byfield, Mass., 1759; d. Cambridge, Mass., 17 July 1810. He was graduated at Harvard in 1784, subsequently entered the ministry, and in 1787 was appointed university tutor of mathematics. In 1789 he was appointed to the chair of mathematics and natural philosophy, which he retained until the death of President Joseph Willard in 1804, when he became his successor. He died while holding this office. He was one of the commissioners appointed to determine the boundary between the United States and the British provinces. He published 'A System of Mathematics' (1801).

WEBER, vā'bẽr, **Ernst Heinrich,** German physiologist: b. Wittenberg, Germany, 24 June 1795; d. Leipzig, Germany, 26 Jan. 1878. He was educated at Leipzig, was appointed professor of comparative anatomy there in 1818, and of physiology in 1840. He originated the formula known as Weber's Law (q.v.) and wrote 'Anatomia Comparativa Nervi Sympathici' (1817); 'Lehre vom Bau und von der Verrichtung der Geschlechtsorgane' (1846); 'Annotationes Anatomicæ et Physioligicæ' (1851), etc.

WEBER, Georg, German historian: b. Bergzabern, Rhenish Bavaria, 10 Feb 1808; d. Heidelberg, 10 Aug. 1888. He was educated at Erlangen, traveled extensively, and was director of the normal school at Heidelberg in 1848–72. His writings, which include 'Lehrbuch der Weltgeschichte' (1847); 'Geschichte der Deutschen Litteratur' (1847); Allgemeine Weltgeschichte für die Gebildeten Stände' (15 vols., 1857–80), etc.

WEBER, Karl Maria (Friedrich Ernst), Baron von, German composer: b. Eutin, Grand Duchy of Oldenburg, 18 Dec. 1786; d. London, 5 June 1826. He was a pupil of J. P. Heuschkel of Hildburghausen, attaining great skill as a pianoforte virtuoso and much proficiency in the technique of composition; and continued his studies with Michael Haydn at Salzburg, and at Munich with Kalcher (harmony and composition) and Valesi (singing). His opera, 'Das Waldmädchen,' was produced with but moderate success at Freiberg, though more fortunate at Chemnitz and (in 1805) at Vienna. A second opera, 'Peter Schmoll und seine Nachbarn,' first presented at Augsburg (1803) met with no particular approval. Early in 1803 he went to Vienna, and there that curious genius the Abbé Vogler was for a year his instructor. By Vogler's aid, he secured the post of kapellmeister of the opera at Breslau (1894). He displayed great ability as an organizer and director, but resigned in 1806, and became musical

director to Prince Eugene of Würtemberg at Karlsruhe, Silesia. In 1807 he entered the service of Duke Louis of Würtemberg at Stuttgart as private secretary, and in 1808–10 was working on his first large opera, 'Silvana,' the libretto of which was to a large extent based on that of his earlier 'Waldmädchen.' He was falsely charged with fraud, and despite all lack of evidence against him, was perpetually banished from Würtemberg 26 Feb 1810. Then he went to Mannheim, where his first symphony was most favorably received, and his piano-playing was also very successful; and thence to Darmstadt, where he once more became a pupil of Volger. His comic operetta, 'Abu Hassan,' was completed in 1810 and given at Munich, and 'Silvana,' with additions, gained adequate recognition at Berlin in 1812. It was not, however, until 1813 that Weber held an important appointment; in that year he was made kapellmeister of the Prague opera, and there proved himself the first of the Great German musicians to be conspicuous also as a conductor. His administration of marked success was brought to a close by his giving it up in 1816. His chief compositions of this period were settings of Körner's songs, and the cantata 'Kampf und Sieg,' founded on the battle of Waterloo. In 1816 he went to Dresden, where previously Italian opera had held undisputed sway, to organize the new venture of German opera; and soon he had attained, except among a few partisans, an unqualified victory. The appointment was confirmed for life, and he was frequently summoned to direct the music of the chapel royal. He became widely known with the presentation of his opera, 'Der Freischütz,' at Berlin, 18 June 1821, which was quickly echoed elsewhere, being simultaneously given in London in three different places. Few operatic works, it is said, have equaled it in immediate triumph. 'Euryanthe' did not meet similar approval at Vienna (1823), though appreciation was duly encountered in Dresden, Leipzig and Berlin. On the commission of Charles Kemble of Covent Garden, London, he wrote 'Oberon' to an English libretto by J. R. Planché, himself learning English to be able to work to better effect. He conducted the first 12 performances, and after a reception which almost surpassed that of the 'Freischütz,' played at numerous concerts. With the 'Freischütz,' which struck a distinctively national note, Weber became the founder of what is known as the romantic school of German opera. He has been claimed as a predecessor of Wagner in adapting his music to the dramatic requirements, and the use of leading motives. In his operatic works he apparently preferred legendary and supernatural elements, which he could make musically effective. Though his operas are the best known of his writings, he did musicianly and even brilliant work in the direction of Lieder and pianoforte compositions. Consult Jähns, 'C. M. von Weber: Eine Lebensskizze' (1873); the biographies by Rau (1865); Benedict (1881); Reissmann (1882); Gehrmann (1899), and his son Max Maria von Weber (Leipzig, new ed., 1912); also Benedict, 'Musiciens du Temps Passé' (1893), and the article by Spitta in Grove's 'Dictionary' (Vol. IV, 1889).

WEBER, Wilhelm Eduard, German physicist brother of E. H. Weber (q.v.): b. Wittenberg, 24 Oct. 1804; d. Göttingen, 23 June 1891. He was educated at Halle, was professor of physics at Göttingen in 1831–37 and occupied that chair at Leipzig in 1842–49, after which he resumed his chair at Göttingen. He was associated with his brothers and with Gauss in various publications concerning physics, and made valuable researches in the fields of electricity and magnetism. He also published a series of essays, 'Elektrodynamische Massbestimmungen' (1846–67). Consult Heinrich Weber, 'Wilhelm Weber' (1893).

WEBER, wē'bėr, a river of Utah, whose headwaters are on the west slope of the Uinta Mountains. It flows northwest through fertile lands and through a series of cañons; and after a course of nearly 200 miles it enters Great Salt Lake. The famous Weber Cañon is the gorge made by this river where it breaks through the Wasatch Mountains. The Union Pacific Railroad passes through this gorge. The descent in places is most rapid, and the consequent water-power is extensive. At Ogden, the mean volume of water is about 2,000 cubic feet a second. The Weber is much used for irrigation. The river has built up at Ogden a large delta which extends into ancient Lake Bonneville.

WEBER'S LAW. In the 30's of the last century E. H. Weber (q.v.) made the discovery that a subject who could barely distinguish between lifted weights of 29 and of 30 ounces could also barely distinguish between weights of 29 and 30 drachms. Similar results were obtained in the case of cutaneous pressure and in the visual measurement of short lines. That is, it appeared in each case that the just noticeable increment of a stimulus was not a constant, but bore instead a constant ratio to the strength of the stimulus itself. This generalization, which is Weber's law, is a precise statement of the fact which is familiar to us in such cases as that of the ticking of a watch, quite inaudible on the noisy street though it may be very loud in the silence of the bedroom. The ratio of the barely observable increment or difference limen to the stimulus is dependent on the kind of stimulus used. For pressures on the tip of the finger it is nearly 0.05, for noise loudnesses it is about 0.33, for lifted weights, 0.033, and for brightness, 0.01. Weber's law is only an approximation at best. It is badly in error for very great or very small stimuli; even for those of moderate intensity it presupposes a complete adaptation of the percipient organ. It is not in general valid for other attributes of sense than intensity, although it seems to hold good for visual extension. In the pitch of tones, for instance, the just noticeable increment is about .75 vibrations per second for a considerable range of the scale. In so far as we are able to equate easily noticeable intervals in different parts of an intensity scale, it appears that these obey the same law as just noticeable intervals; that equal-appearing intervals between stimuli are proportional to the intensity of the stimuli evoking the lower terms of the intervals, and are made up of an equal number of just noticeable intervals. This assemblage of facts was raised by G. T. Fechner (q.v.) to the dignity of a necessary law expressing the relationship of mind and matter. He represented the fact that a constant increment of a sensation is

produced by a fixed proportional change in the stimulus by the formula $s_1 - s_2 = f\left(\frac{i_1}{i_2}\right)$, where i_2 is the stimulus inducing the sensation s_1. We obtain from this at once

$$s_1 - s_2 = f\left(e^{\log \frac{i_1}{i_2}}\right) = f,$$

$$\left(e^{\log i_1 - \log i_2}\right) = \phi, \ (\log i_1 - \log i_2).$$

As i_1 depends only on s_1, and i_2 depends only on s_2 in the same way, we get $s_1 = \phi$, $(\log i_1 - c)$, and $s_2 = \phi$ $(\log i_2 - c)$, where c is the value of $\log i_k$ for $s_1 = 0$. Therefore ϕ $(\log i_1 - c) - \phi$ $(\log i_2 - c) = \phi$ $(\log i_1 - \log i_2)$, so that ϕ satisfies the functional equation $\phi(x) - \phi(y) = \phi(x - y)$.

Differentiating with respect to x, $\phi'(x) = \phi'(x - y)$, which is only possible for all values of x and y if $\phi'(x)$ is some constant such as K_1, or if $\phi(x)$ is of the form $K_1 x + K_2$. It is easily seen that $K_2 = 0$. We thus get $s_1 - s_2 = K_1(\log i_1 - \log i_2)$. By the proper choice of units this becomes $s_1 = K \log i_1$. Fechner's law is, then, that the sensation varies as the logarithm of the stimulus.

There are several serious objections to Fechner's treatment of the law. In the first place, it is more than probable that the basis of the phenomena observed lies rather in the make-up of the nervous system than in the transition from the physical phenomena of the nervous system to the percipient mind. Even Wundt's explanation of the facts by apperception is vitiated by the appearance of the same logarithmic formula in the reactions of the nervous system of a decerebrized frog. Secondly, what is being determined in the mind of the subject of an experiment on discrimination is not the difference between two mental states, but the *awareness* of that difference, which is altogether another thing. The existence of limina is in itself enough to refute Fechner's opinion that it is actually the difference between two mental states which is reported, for things identical with the same thing are identical with one another, whereas a weight of 61 drachms is sensibly equal to the discriminable weights of 60 and 62 drachms. In the third place, while measurement of sensations is a conceivable thing, it is most assuredly not done directly, so that the whole interpretation of Fechner's law remains indeterminate until a thorough logical analysis is made of the processes involved in our actual measurement of the intensity of sensation.

The general types of method used in experiments and investigations on Weber's law are that of just noticeable differences, where two stimuli are gradually separated or approximated until their difference appears or disappears; that of average error, in which the average error of the observer in selecting a variable stimulus equal to a given fixed stimulus is taken as the index of the just noticeable difference or limen; that of equivalents, which differs from that of average error only in that the stimuli are applied simultaneously to different parts of the body rather than successively to the same part; that of mean gradations, in which a supraliminal interval is bisected; and that of right and wrong cases, in which the mean position of the initial stimulus limen or the difference limen is determined by ascertaining throughout a series of trials for each intensity of stimulus or magnitude of stimulus difference the proportion of cases in which its presence or absence is rightly judged. (See LIMINA; PSYCHOPHYSICS). Consult Delboeuf, J. R. L., 'Examen critique de la loi psychophysique' (Paris 1883); Fechner, G. T., 'Elemente der Psychophysik' (Leipzig 1889); Fullertan and Cattell, 'On the Perception of Small Differences' (Philadelphia 1892); Külpe, O., 'Outlines of Psychology' (tr. New York 1909); Meinong, A. (in *Zeitschrift für Psychologie*, Vol. XI, 1896); Muller, 'Grundlegung der Psychophysik' (Berlin 1878); Myers, C. S., 'Text-Book of Experimental Psychology' (2d ed., Cambridge, 1911); Titchener, 'Experimental Psychology' (New York 1905); Wundt, W., 'Grundrüge der physiologischen Psychologie' (Leipzig 1908–11); Ziehen, T., 'Leitfaden der physiologischen Psychologie' (10th ed., Jena 1914).

WEBSTER, Arthur Gordon, American physicist: b. Brookline, Mass., 28 Nov. 1863. He was graduated at Harvard University in 1885, later studied at the universities of Paris and Stockholm, and in 1890 took his Ph.D., at the University of Berlin. He received in 1895 the Thompson prize, Paris, of 5,000 francs for experimental research on the period of electrical oscillation. He was assistant professor of physics at Harvard in 1892–1900; and from 1900 he was professor and director of physics at Clark University. He was appointed to the Naval Consulting Board in 1915; and to the National Research Council in 1917. He is an authority on sound and the inventor of several instruments of value in this connection. Author of 'A Mathematical Treatise on the Theory of Electricity and Magnetism' (1897); 'Dynamics of Particles of Rigid, Elastic and Fluid Bodies' (1903); 'Harrison Lectures on Sound, University of Pennsylvania' (1911), etc.

WEBSTER, Daniel, American statesman: b. Salisbury (now Franklin), N. H., 18 Jan. 1782; d. Marshfield, Mass., 24 Oct. 1852. He was the son of a New Hampshire judge and farmer and brother to a large family of boys and girls, all of whom worked and sacrificed in favor of Daniel whose health was apparently not robust. After rather meagre preparation he attended Exeter Academy a year. Thence he went to Dartmouth College where he was graduated in 1801 with good if not distinguished standing. He loved to study English and classical literature; he liked self-indulgence; and he was already an orator for Fourth of July occasions. More than once he had shown a disregard to that rigid honesty in little money matters which was later to become such a distressing trait of his character.

From Dartmouth to the farm of the hard-pressed father was not a congenial move for a young man so filled with ambition to play a rôle in the great world outside; but the road to the goal he vaguely set himself was not easy to find. He studied law a while in the office of a friendly lawyer nearby but inclined rather to general reading and to fishing than to rigid self-discipline. Next he turned to teaching school in the town of Fryeburg, Me., in the hope of winning ready money, so much needed in the Webster family, now that another son was sent to Dartmouth. After one session at Fryeburg, he returned to his native town of Salisbury and resumed the study of law in earnest. Ezekiel,

the brother who had been at Dartmouth, now took a school in Boston and Daniel followed him to the New England metropolis. Here he studied law under the distinguished Christopher Gore, a little later governor of Massachusetts, and always a prince of the old New England culture. Gore was certainly not of the type of Ezekiel Webster, the farmer judge of New Hampshire, but he was the bitter enemy of that 'Mr. Jefferson, the atheist Virginian' who had broken the power forever of the Federalists of New England. Webster absorbed the politics of localism and provincial superiority which a little later threatened to ruin a great career.

Admitted to the Boston bar on the recommendation of Gore himself in March 1805, Webster, a little past his 23d birthday, returned to his native State and there, in the town of Boscawen, began the practice of his profession. He was quickly successful; but realizing that a larger sphere for the display of his talents was necessary, he removed to the important commercial town of Portsmouth in the year 1807.

Here he came into touch with real New England, with men who went "down to the sea in ships" and brought back rich harvests from the banks of Newfoundland, from the marts of Europe and even from the strange cities of China. He met and competed with great lawyers, like Jeremiah Mason and William Plumer, and he learned to think in generous figures, not in the niggardly shillings and pence of his boyhood. For five years he learned from these men and from renewed study of the great British law authorities. Webster received or gave himself a broad and deep training, whereas his great rival in life, Henry Clay, had little or no training. Moreover he earned large fees in those exasperating years of non-importation acts and embargoes, procured for himself a good town house and went back to his native countryside and married Miss Grace Fletcher, the daughter of the minister at Hopkinton. He spoke against the government on every suitable occasion; learned to write great orations and to move large audiences; and shaped barbed resolutions against James Madison and his inconsiderate Virginians who monopolized all the great offices of the nation. He learned rather better than history has recorded the language of resistance and secession. How could he do otherwise in a community whose people were delighted with young William Cullen Bryant's first poem, "The Embargo." Thus trained, deeply resentful at the policy of the national government in going to war with England a second time and ambitious to meet the enemy face to face, he became a candidate for a seat in the National House of Representatives, was elected on a most flattering vote and took his seat in May 1813.

From 1813 to 1817 Webster served New Hampshire in the House of Representatives. He opposed the Madison administration at every turn as every good New Englander must do. His protests against the conduct of the war, against Federal interference with New England trade and against the conscription of soldiers to fight the war were all animated by a warm and even impassioned sectionalism that reminded one of the Massachusetts secessionist, Josiah Quincy, just retired in disgust from a government which seemed destined to remain in the hands of slave-holding Southerners and ignorant frontiersmen. If Webster was more discreet, it was probably because the exasperation of Southern leadership was not quite so disturbing to him. But Webster was already a great lawyer and very much of his time, as well as the best of his talent, was during these four years spent in the Federal courts, both at Boston and in Washington where Chief Justice Marshall took pains to express his hearty admiration of a fellow partisan who could distress Mr. Madison. When the second term in the house was about to expire, Webster declined to offer himself in New Hampshire for re-election and removed to Boston, having first thought of making New York his home — for there, he said, the great decisions of the near future would be made.

In Boston, he quickly received that recognition and adulation which seems to have become necessary to his happiness and success. From 1816 to 1823, he again practised his profession with eminent success. His income from fees increased, in spite of the lean years that followed the close of the war with England, from $2,000 to $20,000 a year. The wealthy and the distinguished yielded to the son of the New Hampshire frontiersman who lived in the handsome house on Somerset street and deported himself with all the dignity of a Cabot or a Dana. With wealth abounding and social distinction undisputed, even in Boston, Webster now gave himself to the delivery of a series of commemorative orations that made his name known wherever New Englanders dwelt or New England newspapers were read. The Plymouth (1820) and the Bunker Hill (1826) addresses were the best of these, although others, like that on the Character of Washington and on the Landing at Plymouth, were reprinted in every important eastern paper. It was the day of oratory. There were few scholars and the clergy were fast losing their former mastery of the popular imagination. Public men must be learned, or appear to be so, and they must on occasion display their learning and their fine phrases in well-rounded periods. Of all Americans who essayed the rôle of classic oratory on the frontier soil of America Webster was the foremost. He had a remarkable personality; his voice and manner were both imposing and winning; and he had a memory that always served him admirably. When Webster spoke men laid down their tools or stopped their plows in the field and went to hear him. They would gladly stand in great outdoor audiences or crowd themselves into Faneuil Hall for hours at a time on hot days in order to look upon his majestic form or follow his moving imagery. Thus, before the great struggle in the country about the tariff and the powers of the Federal government, Webster was prepared as few men ever had been prepared for attack or defense.

It was an easy matter, then, in 1822 for him to procure once more a seat in the national House of Representatives. He represented Boston. He was a strict sectionalist. In 1814, when he spoke for a New Hampshire constituency, he had threatened to resist the national authority and he sympathized fully with those recalcitrant governors and judges of New England who refused to furnish troops to the national administration or who declared Federal laws inoperative in States that did not approve Federal policy. In 1820 Webster was so much

opposed to the tariff laws of the Union that he threatened secession in a notable speech. When he appeared in his place in the national legislature late in 1823 he was ready for a great struggle.

Henry Clay was the leader of the House of Representatives at that time and he was pressing with all his energies the tariff and internal improvement bills which together he christened the "American System." Webster opposed Clay in the best speech that had ever been made in Congress on the subject of the tariff. It is known as his free trade speech. It was delivered in 1824. The arguments which he then arranged and massed in consummate style have never been answered. But New England was changing. He was a New Englander. In 1825 a New Englander, John Quincy Adams, became President and half of New England changed its investments from shipping to manufactures. Before 1828 Webster was himself in a quandary. He must change his attitude or cease to play a part in public life. His position was exactly parallel to that of Calhoun who had been a strenuous protectionist but whose constituents now became free traders. Calhoun abandoned protection which South Carolina would no longer endure; and Webster abandoned free trade which Massachusetts then and henceforth condemned. Calhoun was the Vice-President and very ambitious to be President. Webster was elected to the Senate in 1827 and he too soon became possessed with the ambition to rise to the presidency.

When Webster took his seat in the Senate, Henry Clay was the Secretary of State and the director of the policy of the party with which Webster must work, the incipient Whig party, the party of protection to American industries, of wide-flung schemes of internal improvements and of expanding the powers of the national government. The New Englander quickly fell into line. In 1828 he made his first important speech in favor of the "American System," so ably condemned four years before, and Calhoun prepared to thwart that very tariff policy which he had done so much to set up in 1816. Nullification was about to be tried and Webster from opposing the national power, as he had done all his life, now prepared to champion that cause. The greatest speech of his life was delivered in February of 1830 when western influences in Congress opposed to the leadership of Henry Clay were being aligned with the southern influences and interests voiced by Calhoun and Robert Young Hayne. These leaders of the three great sections of the country were compelled to work out a national policy which it was hoped that a majority of the people might support.

Thomas H. Benton had pressed for six years his bill for a freer distribution of the public lands in the hope of building up the West at the expense of the East. Webster opposed the Benton plan. The Southerners were divided; but, after long and doubtful negotiations, they had made up their minds to support the western claims in exchange for support of their free trade policy. Jackson was made President upon this combination. Webster did not like the combination. It meant disaster for New England. But Jackson did not like the power and influence of Calhoun in the combination which lay behind his own presidency. When, therefore, Calhoun prepared to launch his nullification program, expecting that Jackson would remain quiescent, there were signs that the President would revolt. It was the primary interest of New England that Jackson and Calhoun should break, that the West and the South should not continue their coalition, or alliance.

Soloman Foot of Connecticut made the first move in his resolutions of early January 1830, in which it was proposed to withdraw the public lands from sale. Benton was quick to denounce the resolution as indicative of the selfish and provincial policy of New England. The Southerners came to the support of Benton. The great debate was begun. Hayne of South Carolina made an elaborate attack upon New England, which roused Webster's ire; but Hayne also publicly announced that the South would support the West in its land program which made him uneasy. To this Hayne also added a long and thoughtful argument against the growing powers of the Federal government. The nation was only a confederation. It was only what the Constitution provided, but not a power of original jurisdiction over the people. Webster replied. He defended New England; said nothing about the subject of the public lands; and closed in a magnificent appeal to the people of the country on behalf of the government as a government of real powers. "The Union, one and inseparable, now and forever." It was strange doctrine from New England. But New England had changed its interest and its attitude. Chief Justice Marshall and the Federal courts had long been working to the same end with New England and the East as a whole. Webster stirred in men a devotion, as yet but half-aroused anywhere, to the ideal of a great national government supreme over all States, all sections and all American citizens. It was to be one of the classics of American oratory. There can be no doubt that it proved to be a powerful influence during the next 30 years. No President, duly cognizant of the meaning of his own office, could remain deaf to an appeal like Webster's. Jackson made it known in April following that he agreed with his New England opponent. When Calhoun's friends would have had him talk of States' rights at a Jefferson dinner, he boldly announced that he drank to the Union, "it shall be preserved." If that were so the alliance of South and West was dissolved and Daniel Webster had done much to dissolve it.

From 1830 to 1850 Webster remained almost uninterruptedly in the Senate. He supported the United States Bank in the long war it made upon the President and the nation he talked of in the great oration. He played a great part in the campaign of 1840 which resulted in the election of William Henry Harrison to the presidency and was under Secretary of State. When Vice-President Tyler succeeded in May 1841 to the office made vacant by the death of Harrison and when Henry Clay undertook to manage Tyler as a modern boss generally manages a governor of his own nomination, Webster revolted against the counsels of his chief, Clay, and retained his seat in the Tyler Cabinet. As Secretary of State under Tyler, Webster negotiated a treaty with the British Minister, Lord Ashburton, which was long known by the names of the two negotiators.

But Webster retired in May 1843. Already

the nomination and election of Henry Clay seemed to be foregone conclusions. Webster, in spite of Clay's dislike of his insubordination, gave earnest support to the Clay ambition. Clay was again defeated and Webster himself now expected that his turn for the leadership of the Whig party had come. He returned to the Senate in 1845 where he renewed his opposition to the annexation of Texas in its final stages. When the war with Mexico began he was, as usual, in full sympathy with the heated and unalterable opposition of his section. But he was too much of a candidate for the presidency to voice his views very strongly. Yet he failed of the Whig nomination in 1848. A successful general and a great slave-holder, Zachary Taylor, received the nomination as a result of Abolitionist opposition to Webster and Clay. Webster declared that it was an improper and unworthy nomination; and both Webster and Clay declined to give public support. Yet Taylor was elected.

Taylor, the slave-holder, urged the admission of California as a free State. As a result civil war between the North and the South seemed imminent. Webster was still in the Senate. Calhoun was again a member in 1845, after a retirement that had been designed to be final. Clay was returned to the Senate at this critical juncture to aid in reconciling the hostile sections of the country, reconcile interests that were in violent conflict. Since Webster, Calhoun and Clay so well represented the three sections — the East, the South and the West — any agreement satisfactory to them was likely to be satisfactory to the country. Clay took the lead, as he had done all his life. Calhoun placed himself in direct and bitter opposition. The South would never consent to the admission of another free State south of the line of 36° 30', extended to the Pacific.

Unexpectedly President Taylor maintained the position that California must be admitted as a free State. A deadlock ensued. From the opening of Congress in December 1849 till the first of March 1850 it seemed that a disruption of the Union must be the outcome. Under these circumstances Clay arranged his last great compromise. It was prepared early in January. Private meetings of senators and representatives were arranged. Old enemies sat down to dinners together and with Clay. Newspaper editors were consulted and combinations made. When Clay at last made his appeal to Congress and the country, he had Webster's consent to follow him with a similar appeal. But President Taylor would have nothing to do with the compromise. Webster and Clay had both said he was an unfit man to be President. Moreover the Southern leaders challenged Taylor, and a challenge of the President as to his powers and his independence has almost invariably been fatal to the challenging party. Taylor would send the United States army into any territory where the Southerners refused to recognize the authority of the United States. That meant immediate war.

Webster had been a nationalist since 1830. He was not in sympathy with the Administration of his own party, which was supported by the Abolitionists. He was by nature a conservative, one who liked to have great social changes made slowly or not at all. He represented the manufacturers and the stable business element of New England and not what would be called the democracy of the North. He made the only decision that he could have made. It was given to the world on 7 March 1850 in a great and eloquent appeal to the public sentiment of the country, North and South, against the disruption of the Union. This decision of Webster broke the deadlock; it ranged his great followers alongside that of Clay. The country rallied to the two old chieftains. The President resisted till 9 July, when death removed him from the scene. Vice-President Fillmore, a friend of Webster and Clay, succeeded and the country breathed freely. In every large town there was a holiday, and big guns announced the passage of the compromise. It had been Webster's decision in March that produced the result. Not even Taylor's military stubbornness could long have withstood the tide of popular demand for a settlement.

Webster entered President Fillmore's Cabinet as Secretary of State and served the ideals of the country well, particularly in the publication of the Hulsemann letter, in which American sympathy for democratic uprisings everywhere was vigorously expressed. But he was denounced for his 7th of March speech most unmercifully. His name was anathematized in 'Ichabod,' one of the widely read poems of Whittier. But the country as a whole did not think less of him, only the people did not demand him for President. When the Whig national convention met in Baltimore, June 1852, to nominate a candidate for the presidency, Webster was the logical candidate. According to all the rules of regular political procedure, the great New England statesman should have received the nomination. But the convention, under the influence of Thurlow Weed and William H. Seward, preferred another military "hero." General Scott was nominated. Webster, broken hearted at the way the North had treated his 7th of March speech and deeply wounded by the conduct of the Whig leaders in Baltimore, went home to Northfield. There he made known his wish that his friends would vote for the Democratic candidate, Franklin Pierce. It was a trying ordeal, the public abandonment of his party. He died before the election. Like so many other great leaders, he died despairing of the republic.

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WEBSTER, Ebenezer, American patriot, father of Daniel Webster (q.v.): b. Kingston, N. H., 1739; d. Franklin, N. H., 1806. In his youth he served under General Amherst in the "old French war," and in 1761 was one of the original settlers of that part of the town of

Salisbury now known as Franklin. He united, as was common at the time, the occupations of farmer and innkeeper, took an active part in public matters, and at the outbreak of the Revolution led the Salisbury militia to Cambridge. Subsequently he fought at White Plains and Bennington, and served in other campaigns until the close of the war, when he had attained the rank of colonel of militia. He was at various times a member of both branches of the legislature, and in 1791 was appointed judge of the Court of Common Pleas, which office he held till his death. In personal appearance he resembled his son Daniel, being of large frame, with a swarthy complexion and dark piercing eyes.

WEBSTER, Henry Kitchell, American author: b. Evanston, Ill., 7 Sept. 1875. He was graduated from Hamilton College, Clinton, N. Y., in 1897, and in the following year was instructor in rhetoric at Union College. With Samuel Merwin, he has written 'The Short Line War' (1899); and 'Calumet "K"' (1901). His own work includes 'The Banker and the Bear' (1900); 'Rogers Drake, Captain of Industry' (1903); 'The Whispering Man' (1908); 'The Girl in the Other Seat' (1911), etc.

WEBSTER, Herbert Tracy, American eclectic physician and author: b. Portland Township, Chautauqua County, N. Y., 14 Oct. 1847. He was graduated at the Eclectic Medical Institute of Cincinnati in 1869, and in 1882 was appointed professor of materia medica in the California Medical College (now located at San Francisco), and now fills the chair of principles and practice of medicine in the same institution. He has written 'Principles of Medicine'; 'Dynamical Therapeutics' and 'The New Eclectic Practice of Medicine.'

WEBSTER, Herman Armour, American artist: b. New York, 6 April 1878. He was graduated at Yale University in 1900 and later studied art under Laurens in Paris. He subsequently lived chiefly abroad. He is known as a painter and is particularly prominent as an etcher. His usual subjects in this field are quaint scenes in out-of-the-way French towns. He has exhibited at the Paris Salon; the Royal Academy, London; the Western Society of Artists, Chicago; Rouen, France; and at the American Art Association, Paris. He is a member of the Royal Society of Painter-Etchers and of the Societé Nationale des Beaux Arts, Paris. He was awarded a gold medal at the Panama Exposition in 1915. His work is represented in the Luxembourg, Paris; the South Kensington Museum, London; the Congressional Library, Washington; the Boston Museum; the Art Institute, Chicago; and in other important collections.

WEBSTER, Jean, American authoress: b. Fredonia, N. Y., 24 July 1876; d. New York City, 11 June 1916. She was educated at the Lady Jane Grey School in Binghamton, N. Y., and at Vassar College. After spending a few years in Italy and traveling around the world, Miss Webster returned to New York, and in 1915 married Glenn Ford McKinney, a New York lawyer. She was a grand-niece of Mark Twain. Her most popular production was the novel 'Daddy Long-Legs' which in its dramatic form was most successful. She wrote also 'When Patty Went to College' (1903); 'The Wheat Princess' (1905); 'Jerry Junior' (1907); 'The Four Pools Mystery' (1908); 'Much Ado About Peter' (1909); 'Just Patty' (1911); and 'Dear Enemy' (1913).

WEBSTER, John, English dramatist: b. about 1580; d. about 1625. He appears to have followed the occupation of his father, a tailor, and in 1604 was a freeman of the Merchant Taylors' Company. In 1602 he began to write plays in collaboration with other playwrights, but attained to his full power only when, between 1607 and 1612, he adopted independent authorship. He added to 'The Malcontent,' a play by John Marston, and was associated with Dekker in writing two vigorous prose comedies, 'Westward Hoe' (acted 1604) and 'Northward Hoe' (acted 1605). 'The White Devil,' or 'Vittoria Corombona,' a tragedy published in 1612, was his first independent work, and is now recognized as one of the best tragedies of its age. 'Appius and Virginia,' published in 1654, followed soon afterward and in 1616 his masterpiece, 'The Duchess of Malfi,' was first produced at the Blackfriars Theatre. It was first published in 1623. This great tragedy, which has won enthusiastic praise from Charles Lamb and many subsequent critics of eminence, is based on a Neapolitan story found in Bandello. 'The Devil's Law Case' was published in 1623 and appears to have been Webster's last play. Of other plays sometimes ascribed in part to Webster, only 'A Cure for a Cuckold' (published 1661) seems to contain any of his work. Webster wrote in 1624 a pageant for the Lord Mayor of London and in 1612 was associated with Heywood and Tourneur in producing 'Three Elegies to the Memory of Prince Henry.' He also contributed verses to other works. There are editions of Webster's works by Dyce (1830; new eds., 1857 and 1886) and Hazlitt (1856). J. A. Symonds edited a selection in the 'Mermaid Series' in 1888 and there is an edition of 'The Duchess of Malfi, in the 'Temple Dramatists' by C. E. Vaughan (1896). Consult Hazlitt, 'Dramatic Literature of the Age of Elizabeth' (ed., 1840); Vopel, 'John Webster: Researches on his Life and Plays' (1887); Gosse, '17th Century Studies' (1883); Swinburne, 'Studies in Prose and Poetry' (1894). Lamb was the earliest among 19th century critics to give due praise to Webster and Swinburne enthusiastically places him next to Shakespeare among English dramatists.

WEBSTER, Joseph Dana, American soldier: b. Old Hampton, N. H., 25 Aug. 1811; d. 12 March 1876; son of Josiah W., minister at Hampton 1808–37. After graduation at Dartmouth in 1832, he studied law; became clerk in the war department, Washington, and was made United States civil engineer in 1835; was commissioned second lieutenant of topographical engineers in 1838; served in the Mexican War; resigned from the army, with rank of captain, 1854, to practice in Chicago as civil engineer. He perfected a system of sewerage for Chicago, the execution of which necessitated raising the grade of a large part of the city and involved many great and novel engineering feats. At the beginning of the Civil War he was charged with the construction of fortifications at Cairo, Ill., and Paducah, Ky.; became colonel of an Illinois artillery regiment

in 1862; as chief of General Grant's staff was present at Fort Henry and Fort Donelson; at Shiloh he was chief of artillery. He was commissioned brigadier-general 29 Nov. 1862, and served as military governor of Memphis and as military superintendent of railroads; he was again General Grant's chief of staff at Vicksburg, and held a like post under General Sherman from 1864 till the end of the war. Having been brevetted major-general of volunteers March 1865, he retired from the army and went back to Chicago; there he was assessor of internal revenue 1869–72, afterward assistant United States treasurer, and finally collector of revenue.

WEBSTER, (Julia) Augusta Davies, English poet and dramatist: b. Poole, Dorsetshire, 30 Jan. 1837; d. Kew, Surrey, 5 Sept. 1894. She was a daughter of Admiral George Davies and was married to Thomas Webster, a Fellow of Trinity College, in 1863. In 1879 she was elected to the London School Board. Her first work was published under a pseudonym, which she soon discarded, and her early inclinations led her to make translations from the Greek in which field she did admirable work. As a dramatic poet she takes high rank, but her verse appeals most nearly to highly cultured readers. Her works include 'Dramatic Studies' (1866); 'Portraits' (1870); the dramas 'Disguises' (1879); 'In a Day' (1882) and 'The Sentence' (1887); 'The Medea of Euripides,' translation (1868); 'A Housewife's Opinions' (1878); 'Daffodil and the Croaxaxicans' (1884), etc.

WEBSTER, Noah, American lexicographer: b. Hartford, Conn., 16 Oct. 1758; d. New Haven, Conn., 28 May 1843. In 1774 he entered Yale College but his studies were interrupted by the outbreak of the Revolutionary War, in which he served under his father as a volunteer. He was graduated in 1778 and was admitted to practise law in 1781, but the unsettled state of the country prevented his obtaining a suitable opening in his profession and in 1782 he removed to Goshen, N. Y., where he taught a classical school. Soon after he published his 'Grammatical Institute of the English Language,' in three parts, Part 1 (1783) containing 'A New and Accurate Standard of Pronunciation'; Part 2 (1784), 'A Plain and Comprehensive Grammar'; Part 3 (1785), 'An American Selection of Lessons in Reading and Speaking.' The first part of this work afterward became popularly known as 'Webster's Spelling-book.' In 1889 it was stated that 62,000,000 copies of the work had then been published. His literary activity was henceforth very great and among works issued by him during the next few years are 'Sketches of American Policy' (1784–85), an argument for the formation of a national constitution. In 1787, after the adjournment of the Constitutional Convention, he published the pamphlet, 'Examination of the Leading Principles of the Federal Constitution'; and 'Dissertations on the English Language' (1789). He began the practice of law at Hartford in 1789, but removed in 1793 to New York, where he established a daily paper, the *Minerva* (later *The Commercial Advertiser*), for the purpose of supporting the government. He published in 1794 a pamphlet on the 'Revolution in France' and wrote 10 essays under the signature of "Curtius" in favor of the Jay Treaty with Great Britain. These publications had a powerful influence in stemming the tide of feeling in favor of a French alliance. In connection with the visitation of yellow fever he made a special study of the history of pestilential diseases and wrote a work on contagious diseases which was published in England and America in 1799. In the previous year he had removed to New Haven. In 1802 he published 'Historical Notices of the Origin and State of Banking Institutions and Insurance Offices.' His great work was the 'American Dictionary of the English Language.' He devoted many years to the collection of new words and preparation of more free and exact definitions. In 1824, when the book was nearly finished, he visited Europe to procure such information as he had been unable to obtain in America. After a short stay in Paris he went to England, where he finished his dictionary during an eight months' residence in Cambridge. In June 1825, he returned to America. An edition of 2,500 copies of his dictionary was published in 1828, followed by an edition of 3,000 in England under the superintendence of E. H. Barker. The work contained 12,000 words and 40,000 definitions not to be found in any similar publication. In 1840–41 he published a second edition in two volumes, with extensive additions to the vocabulary and corrections of definitions.

Noah Webster properly takes rank as the greatest of lexicographers, his work being largely original and of vastly greater scope than that of earlier dictionary makers. He originated most of the accepted dictionary forms and laid the groundwork for the modern comprehensive lexicons. (See DICTIONARY). His 'Collection of Papers on Political, Literary and Moral Subjects' was a reprint of some of his earlier writings. Webster was throughout life associated with many of the most eminent men of the country and always took an active share in public life, supporting his party chiefly by his pen. Several enlarged and improved editions of his dictionary have been published since his death, both in America and in England, and it has always held its place as a standard work. Among his further writings are 'Letters to Dr. Priestly' (1800); 'Origin, History and the Connection of the Languages of Western Asia and of Europe' (1807); and a 'History of the United States' (rev. ed., 1838). Consult the 'Life' by Scudder (1882) in the 'American Men of Letters' series; and Ford's 'Notes on the Life of Noah Webster' (2 vols., New York 1912).

WEBSTER, Pelatiah, American political economist: b. Lebanon, Conn., 1725; d. Philadelphia, Pa., September 1795. He was graduated at Yale University in 1746, studied theology and in 1748–49 was engaged as a preacher. Afterward he entered upon a business career in Philadelphia and gained a considerable fortune. He was a lifelong student of the problems of currency, finance and national resources and during the Revolutionary War aided the cause with both his purse and his pen. He was imprisoned by the British at Philadelphia for more than four months in 1778 and had property to the value of £500 confiscated. Author of 'Essays on Free Trade and Finance' (1779–85); 'Dissertation Upon the Political Union and Con-

stitution of the Thirteen United States of North America' (1783); 'Essay on Credit'; 'Political Essays on the Nature and Operation of Money, Public Finances and Other Subjects' (1791), etc.

WEBSTER, Sir Richard Everard, 1st Viscount Alverstone, English jurist: b. 22 Dec. 1842; d. 1915. He was educated at Cambridge, was called to the bar in 1868, became queen's counsel in 1878 and was Attorney-General in Lord Salisbury's Cabinet in 1885–86, 1886–92 and 1895–1900. He was returned to Parliament for Launceston in 1885 and in 1885–1900 was member for the Isle of Wight. He was knighted in 1885, created a baronet in 1900 and in that year was raised to the peerage; in 1913 he was made a viscount. In 1893 he was one of the British representatives before the Bering Sea arbitration tribunal. He was Master of the Rolls, May–October 1900 and was then appointed chief justice. He served as a member of the Alaskan boundary tribunal in 1903. Shortly before his death he published 'Recollections of Bench and Bar.'

WEBSTER, Mass., town in Worcester County, on the French River and on the New York, New Haven and Hartford and the Boston and Albany railroads, 15 miles south of Worcester. It is in an agricultural region and has considerable industrial interests connected with farm products. A lake (1,225 acres) is one of the attractions of the town. It has cotton and woolen mills, shoe factories and machine shops. It has a good water system. There are 11 churches, a high school, 13 graded public schools, three graded parish schools, a public library, two banks and two newspapers. The government is administered by annual town meetings. Webster was set off from Dudley and Oxford and in 1832 was incorporated. Pop. 12,565.

WEBSTER-ASHBURTON TREATY, The, in American history, a treaty between the United States and Great Britain, negotiated by Daniel Webster and Lord Alexander Baring Ashburton in August 1842. By this treaty the frontier line between the State of Maine and Canada was definitely agreed to. By this agreement seven-twelfths of the disputed ground, and the British settlement of Madawaska, were given to the United States, and only five-twelfths of the ground to Great Britain; but it secured a better military frontier to England, and included heights commanding the Saint Lawrence, which the award of the king of Holland, who had been chosen arbiter, had assigned to the Americans. By the 8th and 9th articles, provisions are made for putting an end to the African slave-trade; and the 10th article provides for the mutual extradition of suspected criminals. See Treaties; United States—History of Arbitration.

WEBSTER CITY, Iowa, county-seat of Hamilton County, on the Boone River, and on the Webster City and Southern, the Chicago and Northwestern and the Illinois Central railroads, about 70 miles north of Des Moines. It is in an agricultural region, in which there are a number of coal mines. It has a shoe factory, foundry, machine shops, iron furnaces, flour mill, grain elevators and large coal yards. Nearby are mineral springs of some importance. It has a high school, graded public and parish schools, four banks and a daily and four weekly newspapers. The city employs a business manager to operate its affairs. Pop. 5,834.

WEBSTER GROVES, Mo., city in Saint Louis County, on the southwestern outskirts of Saint Louis, and on the Missouri Pacific and the Saint Louis and San Francisco railroads. It is chiefly a residential suburb of Saint Louis. The Loretto Academy, the Kendrick Seminary and a Masonic Home are located here. Pop. 7,080.

WEBWORMS, various species of caterpillars or lepidopterous larvæ, so named because of their habit of spinning webs of silk, enclosing leaves upon which they feed, and also serving as a shelter. As a rule neither the web-spinning nor the social habit is so highly developed as in the tent-caterpillars (q.v.), but there is no sharp distinction in the application of the two names. The species of caterpillars exhibiting such habits are quite numerous and belong to a number of genera and families of moths (q.v.). Some of them are of considerable economic importance. The fall webworm is the larva of the small white moth (*Hyphantria cunea*). As soon as they leave the egg all of the larvæ hatching from a mass spin a common web enclosing several leaves. After these are eaten the caterpillars wander farther and farther in search of food, sometimes destroying the entire foliage of a tree, but always returning to the shelter of the nest to rest when not feeding. The web may be extended to include whole branches. The caterpillars are covered with long hairs, and there are two broods, one in the spring and one in the fall, the latter being unusual among species of similar habit, wherefore the name. All kinds of shade and ornamental trees suffer from their attacks. Typical of a large and quite distinct group of caterpillars is the garden webworm (*Loxostege similalis*), which is a small, nearly naked caterpillar, that feeds in company on all kinds of garden vegetables, the leaves of which are drawn together in small webs. Some of the related species form large colonies, and one small form is often very destructive to dried clover hay. The root webworms are caterpillars of the little roll-wing moths. *Crambus vulvivagellus* is a common species, which spins a web about the stalks and roots of grass to which, as well as to corn, it is sometimes very destructive. The true tent-caterpillars (q.v.) belong to the genus *Clisiocampa* and family *Bombycidæ* or silk-spinning moths. A quite unrelated species is *Cacæcia cerasivorana*, which forms veritable silken tents, sometimes covering small trees entirely. The general method of combating webworms is to destroy their eggs in winter, to burn the newly-formed tents and to spray the foliage about the tents with arsenical solutions. The ground-webs may be checked by fall plowing. Consult Harris and Flint, 'Insects Injurious to Vegetation' (New York 1884), and publications of the United States Department of Agriculture.

WEDDERBURN, wĕd'ĕr-bĕrn, **Alexander,** Baron Loughborough, 1st Earl of Rosslyn,

British politician: b. Edinburgh, 13 Feb. 1733; d. near Windsor, England, 2 Jan. 1803. He was educated at the University of Edinburgh, was called to the English bar in 1757, entered Parliament in 1761 as member for Ayr and subsequently represented various constituencies. He pleaded the great Douglas case in 1768–89, and in 1771 left the ranks of the opposition to become a firm supporter of Lord North, who had appointed him solicitor-general. He strenuously opposed the claims of the American colonists, defending the policy of Lord North throughout the American war. He was made chief justice of the Court of Common Pleas in 1780, at the same time being raised to the peerage as Baron Loughborough, and in 1783 assisted in forming the coalition ministry, but in 1784 he joined the forces of Fox. He subsequently made friends with Pitt and gained from him the place of lord chancellor, after which he joined the supporters of George III. Upon his retirement from the chancellorship in 1801 he was created Earl of Rosslyn.

WEDDERBURN, James, Scottish psalmodist: b. Dundee, Scotland, about 1500; d. England, about 1564. He studied at the University of Saint Andrew, became interested in the Scottish Reformation and fled to France to escape prosecution as a heretic. He edited, with his brothers Robert and John, the principal song book used in Scotland, 'Ane Compendius Buike of Godly and Spirituall Sangs, Collectit Out of Sundrie Partes of the Scripture, wyth Sundrie of Uther Ballates Changed Oot of Prophane Sangs, for Avoyding of Sinne and Harlotrie' (about 1548). Later editions of this work have been edited by David Laing (1868) and Mitchell (1897). He is also credited with the authorship of 'The Complaynt of Scotland' (1548), "the only classic work in old Scottish prose." Consult Mitchell, 'The Wedderburns and Their Work' (1898).

WEDDING ANNIVERSARIES, or celebrations, bear many familiar names from the sort of articles considered appropriate gifts on such occasions. They are as follows: Cotton wedding one year; paper wedding, two years; leather wedding, three years; wooden wedding, five years; woolen wedding, seven years; tin wedding, 10 years; silk and fine linen wedding, 12 years; crystal, (glass) wedding, 15 years; china wedding, 20 years; silver wedding, 25 years; golden wedding, 50 years; diamond wedding, 75 years.

WEDDING CEREMONIES. See MARRIAGE, HISTORY OF.

WEDEKIND, Frank, German dramatist and pamphleteer: b. Hanover, 24 July 1864; d. Munich, May 1918. He early became a journalist, but drifted for a time into the employ of Maggi's soups, for whom he conducted their advertising department (1886), traveled as a performer in Herzog's Circus (1888) and settled in Munich in 1890, where he spent the rest of his life in literary and artistic work of various kinds. Wedekind's plays, of which many may be obtained in English translations, are a savage exposure of the sexual hypocrisy of our times, which imposes upon all classes a degree of restraint and concealment of this fundamental passion inevitably resulting in the most dangerous repressions and perversions. His first play treats this situation in a more pathetic and impressive manner than Wedekind has since succeeded in reaching in any of his more ambitious works, for he presents in it ('Fruhlings Erwachen,' 1891, Spring's Awakening') the early sex interest of the child and the cowardice of parents in informing them on matters so vital to their future development. The terrible results of the misunderstood passion on the lives of the boys and girls in the play are perhaps more typical of Germany than of most other countries, owing to the more rigid course of German family life, but they are, in large measure, of universal application. Like several other plays of Wedekind, Frühlings Erwachen' has been played in New York, in English. 'Erdgeist,' also dealing with sex phenomena (1895), is more colossal in its scope almost crushing in the fury of its obsessions; its sequel 'Die Büchse der Pandora' (Pandora's Box, 1904) goes further in depicting the unsavory side of sex relations — Schnitzler's 'Reigen' is probably the extreme in the more aphrodisiac, more tempting direction — than any other play in literature. 'Erdgeist' and 'Die Büchse der Pandora' are more generally known under the collective title of 'Lulu,' the name of the man-consuming heroine. Other important plays are 'Die junge Welt' (1897), 'Der Liebestrank' (1899), 'Der Kammersänger' (played in New York in English, as 'The Tenor,' by the Washington Square Players, 1900). 'Hidalla' (1904), 'Die Zensur' (1908). The last named is a short but humorous dramatic attack on the censorship, with which Wedekind had come in contact because of outspoken utterances in a previous play. In fact, he once fled from Germany from persecution for *lèse majesté* (Majestätsbeleidigung), remained for a short time in Paris, returned voluntarily for trial, and served a short sentence in the fortress of Königstein (1900). After the outbreak of the European War in 1914, Wedekind seems, like many other German writers, to have been attracted to a more sympathetic view of German history and the German government, and wrote (1915) a rather over-patriotic historical play, 'Bismarck,' glorifying the events leading up to the foundation of the modern German Empire. He is one of the most vigorous and original satirists of our time; his ironic, cynical estimate and rejection of the universe is apparent behind all his ingenious puns, his grotesque humor, his eccentric caricatures, his burlesque distortions. As an artist he considers restrictions of form to be not binding, and produces not infrequently results that are refreshing or even childlessly grotesque. His works (7 vols.) appeared at Munich in 1913, and include short stories as well as plays. Biographical works on Wedekind have appeared from the pens of Pissin, Raimund (1905); Kapp, Julius (1909); and Elsner, Richard (1909).

JACOB WITTMER HARTMANN.

WEDGE, something made of hard substance in the form of a V or double inclined plane, for splitting or pushing apart by being thrust between two surfaces. It is often regarded as one of the mechanical powers, but is really an amplification of the inclined plane. The blade of an axe, the head of a chisel and the woodman's wedge are familiar illustrations

of common wedges. A very thin wedge driven with a comparatively light hammer may be made to exert a high degree of splitting force, owing to the mechanical advantage obtained. See MECHANICAL MOVEMENTS, POWERS AND APPLIANCES.

WEDGWOOD, wĕj'wŭd, **Josiah,** English potter: b. Burslem, Staffordshire, 12 July 1730; d. Etruria, Staffordshire, 3 Jan. 1795. He was the son of a potter in the district and on the death of his father was employed in the pottery at nine. An incurable lameness later compelled him to give up the wheel and he removed for a time to Stoke, where he entered into partnership with other potters and where his talent for ornamental pottery was first displayed. In 1759 he returned to Burslem, and set up a small manufactory of his own, in which he made white stoneware, and developed the cream-colored ware for which he became so famous. He presently succeeded in producing a ware so hard and durable as to render works of art produced in it almost indestructible; and he also produced paintings on pottery without the artificial gloss so detrimental to the effect of superior work. In 1771 he erected potteries at Etruria, a village which he founded for his workmen. His improvements in pottery, which included form, substance and decoration, in all of which he attained an excellence rarely equaled, created the great trade of the Staffordshire potteries, which even during his lifetime acquired a remarkable expansion. He made 50 copies of the Portland vase, which were sold for 50 guineas each, a sum which it is said did not cover his expenditure in their production. (See POTTERY; WEDGWOOD WARE). Consult Jewett, 'The Wedgewoods' (1865); Meteyard, Eliza, 'Life' (1860); Rathbone, 'The Masterpieces of Old Wedgwood Ware' (1892-93); 'Life,' by Smiles (1894).

WEDGWOOD PYROMETER, in physics, a pyrometer in which temperature is ascertained by the contraction of baked clay, measured before and after its subjection to the action of heat.

WEDGWOOD WARE. England's most noted art potter was Josiah Wedgwood, born at Burslem, Staffordshire, in 1730. In 1754 he became Whieldon's partner, but started his Ivy House works in 1759, making "cream-color" ware. By 1773 Wedgwood's products were all being made at the newly-erected magnificent works called Etruria. "Jasper" ware (made first in 1775) was Wedgwood's most noted achievement. It was of colored body and decorated with Flaxman's reliefs in white. The texture of the paste was very beautiful and the ware was left unglazed (*biscuit*). It was used, not only in vases and table services, but also as cameos in medallions, plaques, brooches, shoe-buckles, earrings, snuff-boxes, etc. Jasper ground colors were dark and light blues, lavender, pink, two tones of green, black, so-called "lilac" and yellow — the rarest and most coveted of all pieces. First it consisted of a solid colored body of a most beautiful grain, but was later made in a white body and dipped to give a surface of color upon which the delicate white reliefs were laid. A few pieces (made since 1790) are "tricolored." The medallions (Hackwood, as well as Flaxman, did many of the best) contained mythological subjects and beautifully executed portraits of Benjamin Franklin, Robert Boyle, Sir Isaac Newton, Priestly, Hamilton, etc. A fine white ware, named "pearl," was made from a variation of Wedgwood's "Queen's ware" paste (this was his cream-color patronized by Queen Charlotte) used on "shell" patterns and coated with pearl-shell lustre enamel washes. Gold, purple, yellow and silver (platinum) lustre pieces were made from 1792 to 1810 in tea-pots, coffee pots, cream jugs, candlesticks, trays, etc. The black stoneware that Wedgwood called "basalts of Egypt" was used on "Etruscan" (as Greek vases were then called) vase styles, medallions, panels, seals, plaques, busts, tea and coffee sets, etc., with reliefs of mythological scenes, trees, horses, flowers. Noted are the busts in this ware of Zeno, Cicero, Plato, Chaucer, Milton, Spencer, Bacon, Lord Chatham of the larger sizes and the smaller Voltaire, Rousseau, etc. Most famous of Wedgwood's productions is the glass Barberini or Portland vase (see PORTLAND VASE) in black-polished earthenware background with applied white jasper bas-reliefs. Wares of mottled bodies and glazes were made in both Burslem and Etruria, Wedgwood learned this style through Whieldon's "tortoiseshell," granite, agate and other marbled wares. Another variety was the "rosso antico" or unglazed red stoneware, after the Elers brothers' style, used on cream jugs, milk jugs, etc. The so-called Greek "Etruscan" antique pieces were imitated by a method Wedgwood termed "encaustic" painting; they used an enamel paint process that produced a dull (*mat*) surface. As the pieces copied were of the Greek "Decadent" period they are not much admired; such ware is found in tea-cups, jugs, bowls, etc. Wedgwood's "bronze encaustics" still exist but the *bronze* (precipitated gold), adhering only through japanners' size is mostly worn off. Wedgwood produced scarcely any porcelain ware, but his nephew, Byerly (10 years after the great Josiah's death), made a real fine porcelain in small quantities, in unrefined decoration, mostly. Since 1872 porcelain has been produced again in Etruria. This great factory has been continued under the descendants of Josiah to this day.

Characteristics and Marks.— True pieces having the "Wedgwood" mark and word "England" date from 1791, then the country of origin was added. "Old" Wedgwood body has been compared with a "baby's skin"; Church describes it as "ivory, neither dry and chalky-looking on the one hand, nor of waxy smoothness on the other; Yoxall says it "feels like a clay-pipe which has a film of soap-bubble over it." In Josiah's day the body had a perfect homogeneity and the workmanship showed "no ripples or stringiness" as appeared later. Marks are "Wedgwood & Bentley," "WEDGWOOD & BENTLEY," "WEDGWOOD & BENTLEY, ETRURIA," in a circle; also "W. & B." These were during the Bentley partnership, otherwise "WEDGWOOD" alone was used. The mark is always *impressed*. Much has been said of the Wedgwood forgeries, but they are so rare as to be almost considered negligible. Neither the ware nor the impressed mark are easy to closely imitate. Voyez, when dismissed by Wedgwood, made cameos in Wedgwood style and he was

a 'perfect master of the antique style,' few are known of. William Adams (worked under Josiah) made fine jasper cameos, but gave them the mark 'Adams' impressed. Garnier says a Herr Schmidt, at a Bayreuth factory (19th century), imitated Wedgwood's stoneware, using his mark.

Bibliography.— Burton, W., 'English Earthenware and Stoneware' (New York 1904); Church, A. H., 'Josiah Wedgwood, Master Potter' (London 1903); Jewitt, L.I., 'Life of Josiah Wedgwood' (London 1865); Meteyard, E., 'The Life of Josiah Wedgwood' (London 1865–66); id., 'Wedgwood and his Works' (London 1873); Rathbone, F., 'Old Wedgwood' (London 1893).

CLEMENT W. COUMBE,
Technical Art Expert.

WEDMORE, Frederick, English author: b. Richmond Hill, Clifton, England, 9 July 1844. He was educated in France, has been art critic on the London *Standard* since 1878 and has published an edition of Michel's 'Rembrandt'; 'Poems of the Love and Pride of England' with his daughter Millicent. Among works of his own are 'Pastorals of France' (1877); 'Life of Balzac' (1890); 'Studies in English Art' (1876; 1880); 'On Books and Art' (1899); 'The Collapse of the Penitents,' a novel; 'Turner and Ruskin' (1900), etc.

WEDNESBURY, wĕnz'bŭ-rĭ, England, a manufacturing town in Staffordshire, 19 miles south-southeast of Stafford and 120 miles northwest of London. The Gothic parish church stands on the summit of a hill at the northern extremity of the town; there are several other churches and chapels, a town hall, free library, a mechanics' institute, public baths, a benevolent society, an almshouse and several schools. The principal manufactures are railway carriages, patent axles and general ironwork for railways; steel tubing for gas and water and steam pipes; gun locks and barrels, springs for coaches, hinges, nails, screws, spades, shovels, edge tools and wrought-iron work of every description. Pop. about 30,000.

WEDNESDAY, the fourth day of the week. The Germans call it *Mittwoch* (midweek). The English name is derived from the old Scandinavian deity Odin or Woden. In Anglo-Saxon it is *Wodnesdæg;* in Swedish, *Odensdag;* in Dutch, *Woensdag.* See also ASH-WEDNESDAY.

WEED, Clarence Moore, American naturalist: b. Toledo, Ohio, 1864. He was graduated from the Michigan Agricultural College in 1883 and is at present teacher of nature study at the Massachusetts State Normal School at Lowell. He has written 'Insects and Insecticides' (1893); 'Ten New England Blossoms and Their Insect Visitors' (1895); 'Seed Travelers' (1898); 'Insect World' (1899); 'The Flower Beautiful' (1903); 'The Nature Calendar Series' (1902–03); 'Bird Life Stories' (1904); 'Our Trees, How to Know Them' (1908); 'Wild Flower Families' (1908); 'Farm Friends and Farm Foes' (1910); 'Seeing Nature First' (1913).

WEED, Edwin Gardner, American Protestant Episcopal bishop: b. Savannah, Ga., 23 July 1837. He was educated at the University of Georgia and studied theology at the General Theological Seminary whence he was graduated in 1870. He took priest's orders in the Episcopal Church in 1871 and was rector of the church of the Good Shepherd, Summerville, Ga., 1871–86. In the year last named he was consecrated bishop of Florida.

WEED, Stephen Hinsdale, American soldier: b. New York, 1834; d. near Gettysburg, Pa., 2 July 1863. He was graduated from West Point in 1854, served on the Texan frontier and in Florida wars of 1855–57, receiving rank as lieutenant in 1856, and in 1858–61 he was on duty in Kansas and Utah. In 1861 he was promoted captain and assigned to the command of a battery in the Army of the Potomac. He was engaged in the Maryland, Peninsular and Northern Virginia campaigns and fought at Manassas, Antietam and Chancellorsville, receiving promotion to brigadier-general of volunteers for gallantry at the latter. He commanded a brigade of artillery at Gettysburg 2 July 1862 and was killed while holding Little Round Top against the terrific onslaught of the Confederates. The place where he fell is now called 'Weed's Hill.'

WEED, Thurlow, American journalist and political leader: b. Cairo, Greene County, N. Y., 15 Nov. 1797; d. New York, 22 Nov. 1882. He entered a printing office at 14, but left his trade for a time to serve in the army during the War of 1812; in 1815–19 he worked as a printer in New York, and in 1819 went to central New York State, where he established and edited successively *The Agriculturist* at Norwich, and the Onondaga County *Republican* at Manlius. In 1822 he became editor of the Rochester *Telegraph,* a daily paper, and later its proprietor. During the Anti-Masonic excitement he stopped the publication of the *Telegraph* and issued the *Anti-Masonic Enquirer.* He was twice elected to the State legislature on the Anti-Masonic ticket, and while in Albany became noted as a shrewd political manager. In 1830 he moved to Albany and established the Albany *Evening Journal,* which he edited till 1865. This paper was first used as a means of attacking the Albany 'Regency,' a body of politicians under the leadership of Martin Van Buren, and it soon became the leading journal of the Whig party in the State. Through the influence of this paper and his political skill, Weed became the dominant State manager of the Whig, and later of the Republican, party. He held no public office himself, but for many years practically controlled the nominations for State officers; his control being used as a rule for the public good; some of the most efficient governors of the State were elected under his management. He also took a leading part in national politics as early as 1824, and when J. Q. Adams was nominated for the Presidency was instrumental in uniting the Clay and Adams factions; was particularly influential in securing the nomination of Harrison in 1840, Clay in 1844 and Taylor in 1848, and materially aided in the nomination of Scott in 1852 and Frémont in 1856. In 1860 his first choice for the Presidency was Seward, but he loyally supported Lincoln after his nomination and urged his renomination in 1864. Weed had long been a personal friend of Seward and was for some time closely

associated with Seward and Greeley in what was known as "the political firm of Seward, Weed and Greeley." In 1861 he went to Europe on a diplomatic mission to place the North in a favorable light before foreign governments and to prevent their intervention in behalf of the South. After 1865 he was for a time a member of the editorial staff of the New York *Times;* in 1867–68 was editor of the *Commercial Advertiser* in New York. His health then forced him to resign continuous journalistic work, but he continued to write occasionally for newspapers and periodicals, and though he took no active part in politics, his advice was sought by Republican leaders and had no small influence in shaping the policy of the party. He published 'Letters from Europe and the West Indies' (1866), and prepared his 'Autobiography,' which was published after his death (1884). Consult Barnes, 'Memoir of Thurlow Weed' (1884); Alexander, 'Political History of New York' (New York 1906).

WEED, Walter Harvey, American geologist: b. Saint Louis, Mo., 1 May 1862. He was graduated as mining engineer from Columbia University, School of Mines (1883) and appointed assistant geologist, United States Geological Survey in that year. In 1883–89 he was engaged in Yellowstone Park investigating hot springs and geysers, and glacial and sedimentary formation. To him is due the discovery that the brilliant coloring about hot springs and geysers are not mineral but due to living algæ; and he also found and described Death Gulch. He also made the discovery that Death Gulch gave out carbon dioxide gas from an extinct hot spring, and it was this that killed wild animals that strayed there. He was occupied in general geologic exploration work in Montana, 1889–98. His most notable contribution to science was the theory of secondary enrichment of mineral deposits published in 1899, now generally accepted. This was followed by the theory of enrichment by ascending alkaline waters. He was one of the first to describe contact metamorphic ore deposits, and to interpret replacement deposits correctly. He is a member of practically all important scientific societies and was appointed special expert and commissioner on copper for Louisiana purchase exposition, 1904. In 1906 he resigned from United States Geological Survey to become chief geologist and examining engineer for General Development Company, and in 1910 went into private practice as consulting engineer and mine valuer. In recent years he has been expert witness in many important mining lawsuits. His publications include 'Copper Mines of the World'; 'Nature of Mineral Deposits' (a textbook, a revision and translation of Beck's German treatise); 'Geology of Butte, Montana'; 'Geysers'; 'Secondary Enrichment'; and many papers of the United States Geological Survey and in 'Transactions' of the American Institute Mining Engineers, and the technical journals.

WEEDEN, William Babcock, American manufacturer and economic and historical writer: b. Bristol, R. I., 1 Sept. 1834; d. 1912. He studied at Brown University, and then engaged in the manufacture of woolen goods in Providence. In 1861 he joined the Union army as first lieutenant of artillery; was promoted captain after the first battle of Bull Run; was present during the siege of Yorktown, and took part in the engagements at Hanover Court House, Mechanicsville, Gaines' Mill and Malvern Hill. In August 1862 he resigned and resumed business in Providence. His publications include 'Mortality of Prohibitory Liquor Laws' (1875); 'Social Law of Labor' (1882); 'Economic and Social History of New England, 1620–1789' (1890); 'War Government' (1906); 'Early Rhode Island' (1911).

WEEDS are plants growing where they are not desired. There are no plants which are weeds, *per se*, since in nature each plant has its place, and since in cultivated areas any plant, useless or useful, may become a weed. Thus grass would be considered a weed in a bed of garlic, and vice-versa. Many plants, however, are popularly dubbed weeds because they are troublesome in fields and gardens, but even among these are not a few which are cultivated; for instance, purslane, lamb's quarters and sorrel. Far from being the useless and obnoxious things that they have long been reputed to be, weeds have performed a distinct service, which they still continue, in agriculture; they have compelled the husbandman to practise clean cultivation, upon which the success of his crops very largely depends.

Weeds often must be eradicated upon land that has become foul under neglect. Upon pastures and lawns that commence to fail the two principal ways of management are to make more grass grow or to plow the land and grow some other crop upon it for a year or more. The former is usually more feasible with lawns; the latter with meadows and pastures. Often a reseeding to grass will be sufficient. The plantain, dandelion and similar weeds troublesome in lawns may be cut out individually, but to keep them out the growth of grass must be encouraged by sowing extra seed and by fertilizing. In land that has lain fallow the annual weeds may be destroyed by frequent cultivation; biennial and perennial weeds, by short rotations of crops, especially such as include intertillage crops, like potatoes, beans and turnips. The one necessity to observe in combating perennial weeds is to prevent their forming leaves and thus elaborating food. In low grounds where sedges, rushes and bracken often abound, the land may be rid of these weeds by draining. In gardens many weeds may be "smothered" by growing leafy crops which will shade the ground. Ground which is kept free from weeds in the early months may become choked with weeds toward autumn and these may reseed the ground for the following year. Mowing before the plants blossom, or plowing the ground are often practised. In some cases, however, the plants may be allowed to remain as a cover crop to prevent the washing of the soil during winter. This practice is most common in orchards. A cover crop sown by the orchardist is preferable.

Besides the usual means of seed dispersal, such as wind and water, weeds are frequently distributed by means of baled hay, manure, and imperfectly cleaned seeds of the crops sown. This last is particularly prevalent with such difficulty cleaned seeds as grass and clover. Hence the advisability of purchasing only the

best seeds. It is not remarkable that many of the most troublesome weeds are imported from foreign countries, because being removed from their natural controls they find less resistance and spread accordingly.

Weeds are often of service in aiding the farmer to judge the needs of his land, since many kinds grow only where the conditions are peculiarly adapted to them. The character of their growth also indicates the quality of the soil. Wild carrot and the ox-eye daisy grow only upon poor soils, or soils that have been robbed of their fertility. Sheep sorrel indicates acid land and the necessity of applying lime to "sweeten" the soil. Bracken, sedge and moss show that the land needs drainage. Dark green foliage and large size of plant and leaf are good indications of abundant nitrogenous plant food in the soil; and yellowish foliage and sparse, stringy growth shows lack of this material.

WEEHAWKEN, wē-hä'kĕn, N. J., town in Hudson County, on the Hudson River, and on the New York, Ontario and Western and the West Shore railroads, opposite New York. It is one of the largest coal depots in the United States. It has the coal docks and freight sheds of the Erie Railroad Company and the coal docks of the Delaware and Hudson Canal Company and the Pennsylvania Company. It has several manufacturing establishments. Two of the Hackensack Water Company reservoirs are located here. Weehawken is known as the dueling place of Alexander Hamilton and Aaron Burr. The post office of Weehawken is in the town of Union adjoining. Pop. 13,000.

WEEK, a period of seven days, one of the common divisions of time. The week is an arbitrary division of time, and the question when, why and by whom it was first adopted necessarily arises in connection with its actual prevalence. One explanation is that the number seven occurs so conspicuously in mythical and occult lore. It was also early used as an indefinite unit, and things were counted by sevens, where later they were enumerated by dozens or hundreds. Another natural explanation offered is that it has been adopted as a quarter lunation; but as there is no absolute necessity for dividing the month into four, and a large fraction is needed to make the weekly square with the lunar periods, this explanation is not satisfactory. The week is, in fact, a much closer division of a year than of a month; but the division of the year into 52 portions is so purely arbitrary that this can hardly suggest the origin of the week. The convenience of some short recurring period or cycle of days is obvious, and it is the prevalence alone, and not the occurrence of a particular cycle, that has to be accounted for. The practice of antiquity on the subject does not seem to have been so uniform as is sometimes supposed. Among the nations who adopted the week as a division of time, the Chinese, Hindus, Egyptians, Chaldæans, Jews, Persians and Peruvians have been mentioned, but in some cases the antiquity of the practice is doubtful, and in others the name has been applied to other cycles than that of seven days. The nations with whom the weekly cycle has been traced with certainty to the greatest antiquity are the Egyptians and the Hebrews. With the former we only know of its existence, but with the latter it had a much more important character. Their earliest records speak of its existence, and refer it to a period previous to that of the nation itself. Laban, the uncle of Jacob, alludes to the week as an established measure of time in Gen. xxix, 27. The origin of the week is further ascribed in the Jewish Scriptures to the creation of the world, and is wrought into the institutions of the nation in a variety of ways, but particularly by the consecration of the seventh day to the worship of the Creator. The Hebrew word for week is of a general signification, and applies equally to a period of seven days, seven months, and seven years, each of which had a particular celebration attached to it in the Hebrew ritual, hence the use of days to represent years in the prophetic writings is according to the natural genius of the language. The number seven had a mystic significance attached to it in the symbolism of the Jewish religion in a variety of other ways. The Romans and Greeks each divided the month into three periods (see CALENDAR), and were not acquainted with the week till a late period. The Romans, however, had for civil uses, as the arrangement of market-days, a cycle of eight days, the ninth day being the recurring one, instead of the eighth, as with us. The use of the week was introduced into the Roman Empire about the first or second century of the Christian era from Egypt, and had been recognized independently of Christianity before the Emperor Constantine confirmed it by enjoining the observance of the Christian Sabbath. The names given by the Romans to the days of the week, and which have pervaded Europe, were derived from the planetary system, which was supposed to consist of the sun, moon and five planets, Mars, Mercury, Jupiter, Venus and Saturn. With the Mohammedans the week has also a religious character, Friday being observed by them as a Sabbath. The Chinese week is said to consist of five days, named after the five elements, iron, wood, water, feathers and earth. See articles on the different days of the week.

WEEKES, wēks, **Henry**, English sculptor: b. Canterbury, 1807; d. 29 May 1877. He was for many years the principal assistant of the sculptor Chantrey, was elected to the Academy in 1863 and became professor of sculpture there in 1873. Besides the earliest bust of Queen Victoria (1837) he executed statues of Latimer, Cranmer, Bacon, Charles II and others.

WEEKS, Edwin Lord, American artist: b. Boston, 1849; d. Paris, 17 Nov. 1903. He was a pupil of the Beaux-Arts (Paris), of Gérôme, and Bonnat, and sketched and painted in Cairo, Jerusalem, Damascus, Tangier and other parts of the Orient, obtaining there material for the genre-scenes from Eastern life with which he won his reputation. A frequent exhibitor at the Salon, he obtained honorable mention there in 1885. Among the other distinctions which he received were the diploma of honor at the Berlin international exhibition in 1891, and a special medal and prize in 1896 at the empire of India exhibition (London). Specimens of his work are in the Pennsylvania Academy of Fine Arts, Philadelphia, the galleries of Greater New York, and the Corcoran Gallery of Washington. Among his paintings are 'Cup of Coffee in the Desert'; 'Jerusalem

from the Bethany Road'; 'Pilgrimage to the Jordan'; 'Scene in Tangier'; 'Arab Story-Teller' (exhibited at the Centennial Exhibition, Philadelphia, 1876); 'Departure for the Hunt — India'; 'Moorish Camel-Driver.' He also wrote 'From the Black Sea Through Persia and India' (1895), and 'Episodes of Mountaineering' (1897).

WEEKS, John Wingate, American legislator: b. Lancaster, N. H., 11 April 1860. He was reared on a farm and in 1881 was graduated at the United States Naval Academy and in 1881–83 served as midshipman in the United States navy. In 1886–88 Mr. Weeks was assistant land commissioner of the Florida Southern Railroad and from 1888 to 1912 was member of Hornblower and Weeks, bankers and brokers, of Boston. He was alderman 1900–02, and mayor in 1903–04 of Newton, Mass., was chairman of the Republican State convention in 1905 and a member of Congress from 1905 to 1913 from the 12th Massachusetts district. He was a member of the United States Senate from 1913 to 1919; received 105 votes for the Presidential nomination in the Republican National convention, Chicago, in 1916 and in 1898 commanded a division of the Massachusetts Naval Brigade with rank of captain. In 1918 Mr. Weeks was defeated for re-election to the Senate.

WEEKS, Raymond, American philologist and phonetician: b. Tabor, Iowa, 2 Jan. 1863. He was graduated at Harvard University in 1890 and later studied at the universities of Paris and Berlin, taking his Ph.D. at Harvard in 1897. He was professor of the Romance languages at the University of Missouri in 1895–1908; held that chair at the University of Illinois in 1908–09, and at Columbia University since 1909. He was in the ambulance service in France in 1917–18. In 1910 he was one of the founders of the *Romanic Review*. He was an assistant editor of the 'New Standard Dictionary' (1913); and is general editor of the Oxford French Series. He was joint author of 'The N. E. A. Phonetic Alphabet' (1912); has contributed verse and short fiction to the magazines; and is author of 'Origin of the Covenant Vivien' (1902); 'La Chivalerie Vivien' (1909), etc.

WEEKS, Feast of (Heb. *Shabuoth*), the second of the great Hebraic religious festival. it is thus called from the fact that it forms the culmination of the seven weeks succeeding the Passover feast. Primarily it appears to have been connected with the celebration of the end of the harvest, but later also with the giving of the Law on the 50th day after the departure from Egypt. In the New Testament it is called Pentecost (q.v.), the Greek word (πεντηκοστή) signifying 50th (from ἡμέρα, day).

WEEMS, wēmz, Mason Locke, American Protestant Episcopal clergyman: b. Maryland, about 1760; d. Beaufort, S. C., 23 May 1825. He began the study of medicine, but gave it up and went to London, where he was educated for the clerical profession, but found no bishop in England to admit him to holy orders. There was then no Anglican bishop in America, and the professional plans of Weems were obstructed by peculiar difficulties. (For an account of them consult McMaster's 'History of the People of the United States,' Vol I). Returning to this country, he preached at different places, apparently never having a regular charge, although it has been said that the rectorship of Mount Vernon parish (there was no such parish) was held by him before the Revolution, as claimed by himself; also that he officiated in the old Pohick Church, of which Washington was an attendant, which indeed he may have done, but not until long after Washington's attendance there had ceased. About 1790 he became a book agent for Mathew Carey (q.v.), and traveled through the South selling works, some of which were his own. He made himself popular by exercising his talents for comedy and his skill with the violin, probably diverting and (through his sermons) exhorting the people by turns. A book of his own writing which he offered for sale was 'The Drunkard's Looking Glass' (6th ed., 1818). His 'Life of Washington,' by which he is best known, first appeared in 1800, and during the 19th century the number of its editions exceeded 70. The traditional conception of Washington rests mainly upon this work, as do the story of the cherry-tree and other anecdotes which historians reject, most of which first appeared in the 5th edition (1806). His other publications, all more or less tawdry and inaccurate, include 'Life of General Francis Marion' (1805); 'The Philanthropist' (10th ed., 1809); 'God's Revenge Against Gambling' (3d ed., 1816); 'Life of Benjamin Franklin, with Essays' (1817); 'Life of William Penn' (1819); 'Hymen's Recruiting Sergeant' (7th ed., 1821 and 'The Bad Wife's Looking Glass' (2d ed., 1823).

WEENDIGO, wĭnd-ĕgō (meaning "cannibal") mythical tribe of Indians believed in by the Algonquin and other eastern races. The Chippewa and the Ottawa thought they inhabited an island in Hudson Bay; while certain other tribes placed them indefinitely in the far north country. Indian stories tell of a terrible Weendigo with two faces and monstrous ears, who could see and hear everything. The "great weendigo" was a monster so huge that his step shook the earth. So terrible was his gaze that no one looked upon him and continued to live. For this reason no one could accurately describe him. He lived far within the forest; but, for the same reason, no one knew exactly where. Like the forest Indians, he was much of a wanderer, and consequently was found, now in one place, now in another. For this reason he was the more to be feared, as one was liable to come upon him suddenly when least expected. But though no one had lived to describe him, there were many who had heard his tramp as it shook the forest and his terrible voice as he roared in rage. Sometimes the Great Weendigo makes himself small and induces the unwary warrior or hunter to follow him; but he who does so never returns. He is much taller than the tallest wigwam ever built, and his ears stick out like those of a mountain cat. These he uses for hunting bags; and in them he stores, for the time being, all he does not care to eat. The Great Weendigo is supposed to be especially fond of children and to keep a supply of them constantly in his great ears. Sometimes children thus imprisoned have escaped from the Weendigo, when the proper magic has been brought to bear upon the giant. A customary way of frightening Algonquin children into being good was to tell them the Weendigo would

catch them and put them in his ears, or roast them and eat them. Numerous mythical folk-tales have grown up about the Weendigo, many of which are imaginative and dramatic. The Great Weendigo had the power of self-transformation; and he frequently changed his form to gain his ends. The Weendigo was firmly believed in from the Hudson Bay to the head of Lake Superior and throughout all the Algonquin country from this line eastward.

WEENIX, Jan, yän vā'niks, THE YOUNGER, Dutch painter, son of Jan Baptist: b. Amsterdam, 1644; d. there, 20 Sept. 1719. He painted landscapes, animals, flowers and fruit, but excelled in the representation of dead game and hunting scenes. His pictures of this class are unrivaled by any productions of the Dutch schools, and command large prices. He finished with extreme neatness, and exhibited a clear and brilliant coloring and a wonderful knowledge of chiaroscuro.

WEENIX, Jan Baptist, Dutch painter: b. Amsterdam, 1621; d. Ter May, near Utrecht, 1660. He was instructed by Abraham Bloemart and Nicolas Mojert, and at 22 visited Rome, where he acquired a reputation by his Italian seaports and landscapes with architectural accessories. The last 12 years of his life were passed in Holland. He was a rapid painter, having been known to finish three half-length portraits with accessories in a single day, and excelled in history, portrait, animal, landscape and marine painting, being on the whole most distinguished in the last-named department.

WEEPING CROSS, a cross of stone or wood, erected at the side of a road, at which penitents prayed and wept for their sins. Hence the old English saying, "To return by weeping cross," that is, to return in sorrow from some message or undertaking. These crosses were removed in England when that country became Protestant, and the saying is now obsolete.

WEEVER (variant of weaver, or of the obs. *wiver*, from Lat. *vipera*, viper), a fish of the genus *Trachinus*, two species of which are recognized: *T. vipera*, five to six inches in length, and *T. draco*, 10 to 12 inches. They possess sharp opercular and dorsal spines, with which they can inflict a painful wound. The sting is believed not to be poisonous, but it is very similar to that of the sting-ray (q.v.). The name weever is hence applied to any of the *Trachinidæ*.

WEEVIL, a general name applied not only to various genera of adult beetles but also to their larvæ. They form a group *Rhynchophora*, or snout-beetles, so called from the characteristic production of the head in the form of a prominent snout, bearing the elbowed antennæ at the sides and the small mouth at its tip. There are several families, but most of these beetles belong to the Curculionidæ, which is said to include upward of 600 genera and 20,000 species. All of them are vegetarians and the larvæ are little white or yellow, fat footless grubs which mostly live within the tissues of plants, and are especially destructive to nuts, seeds and fruits. One of the most conspicuous and harmful is cotton-boll weevil (*Anthonomus grandis*). It is about one-fifth of an inch long and may be differentiated from related species by the fact that the tibiæ of the first pair of legs are provided with two small spines. Immediately after transforming from the pupal state the color is reddish but some time after emergence the color becomes considerably darker. The grub-like larvæ are considerably longer than the adults, strongly curved, white with pale yellowish heads. The eggs are deposited in punctures made by means of the beak of the female weevil in the buds (called squares) and bolls. The larvæ devour the interior. Infested squares practically invariably fall to the ground but bolls always remain attached to the plant. In the case of the squares, of course, the fruit is ruined. In case of bolls only the infested like or apartment is destroyed. The life-cycle is completed in about 20 days and there is an inextricable confusion of generations. The winter is passed in the adult stage, the individuals flying to the woods or seeking shelter in débris around or inside of the cotton fields.

This insect probably originated in Central America. It was introduced into the United States near Brownsville, Tex., about 1892. By 1895 it became established as a serious pest and has continued to spread northward and eastward. It has now extended about 585 miles northward from Brownsville and to a point within 10 miles of the Mississippi River in Louisiana. Five counties in southwestern Arkansas have also become invaded. Efforts to stay the progress of the weevil have been unavailing, but an effective method of mitigating its damage has been perfected. The methods of destroying or controlling recommended by the Department of Agriculture, which has published several valuable pamphlets on the natural history and injurious work of this insect, are the removal of the plants from the fields in the fall when there is no prospect of any more fruit being allowed to mature; early planting, the use of early maturing varieties, the application of fertilizers and intensive cultivation.

The grain-weevil (*Sitophilus granarius*) is a little dark red beetle about an eighth of an inch long. The eggs are deposited on wheat after it is stored, and the larvæ burrow therein, each larva inhabiting a single grain. The rice-weevil (*S. oryzæ*) destroys rice and Indian-corn in a like fashion; this species has four red spots on the elytra or wing-covers. Another species (*Calandra palmarum*) infests palm-trees, is common in Guiana and attains a length of two inches, the larvæ burrowing in the pith of the trees. *C. sacchari* inhabits sugar-canes. The genus *Rhynchites*, of which the grape-weevil (*R. bacchus*) is an example, has the head broad behind; it devastates the growing vines, and strips them of their leaves. The plum curculio (*Conotrachelus nenuphor*) causes great damage to plums, cherries and other stone fruits. The eggs are laid one at a place in the young, forming fruit, upon the flesh of which the larva feeds, causing it to drop prematurely or to become "wormy." The beetle is less than one-fifth of an inch long and dark brown spotted with black and yellow. The familiar chestnut-worm is the larva of *Balaninus rectus*, remarkable for the great length of the snout, which exceeds the short robust body and which is adapted for piercing the thick burrs of the

young chestnuts, permitting the deposition of an egg in the kernel. Related species of the genus infest other nuts. Equally troublesome to fruit-growers are the species of *Anthonomus*, of which one pretty little weevil (*A. signatus*) causes great damage to the Sharpless and other staminate varieties of strawberry. This species attacks the flowers, and the larvæ feed upon the pollen. Quite different in its habits is the potato weevil or potato-stalk borer (*Trichobaris trinotata*), the larva of which bores passages in the stems of potatoes and wild plants of the same family. The clover-weevil (*Phytonomus punctatus*) has green larvæ, which differ from all of the foregoing in living exposed to the air and light, though they feed chiefly at night. They eat the leaves, and as they hibernate in the ground and begin to feed almost as soon as the clover sprouts in the spring they become most serious pests. The adults are nearly a third of an inch long, thick-bodied and short-snouted, with strongly knobbed antennæ.

To the family *Bruchidæ* belong the extremely destructive pea and bean weevils, which have the proboscis short and curved down on the breast and the antennæ not elbowed. They are small beetles with stout bodies and the swollen abdomen often projecting beyond the tips of the wing-covers. Unlike the *Curculionidæ*, which become quiescent and assume an appearance of death, these beetles are extremely active and fly when disturbed. The larva of the pea-weevil (*Bruchus pisi*) damages peas, the eggs being laid when the peas are ripening. They destroy much of the substance of the grain, lessen its germinating power and pupate in its interior. The mature insect is black marked with white spots, and about an eighth of an inch long. The *B. pisi* was at one time so destructive in North America that its ravages threatened to wholly exterminate the pea crops. Several species are named corn-weevils, from their destructive effects in granaries. *B. granarius* also attacks peas, and one species infests the cocoanut. The bean-weevil (*B. fabæ*) is plain brown in color but otherwise similar.

Weevils are very difficult to control on account of their small size, inconspicuousness and the fact that the destructive larvæ are generally beyond the effective reach of insecticides. The best measures consist in the total destruction by burning of all infested fruits, nuts or stems, the digging or plowing in the late fall of the ground in which the pupæ hibernate, and in the case of the pea and bean weevils the fumigation with carbon bisulphide of all infested seed. Consult Harris and Flint, 'Insects Injurious to Vegetation' (New York 1884); Saunders, 'Insects Injurious to Fruits' (Philadelphia 1883); Smith, 'Economic Entomology' (Philadelphia 1896); and special papers published numerously by the United States Department of Agriculture and by the experiment stations of various States.

WEEYOT. See WISHOSKAN.

WEIDNER, wīd'nėr, **Revere Franklin,** American Lutheran theologian: b. Centre Valley, Pa., 22 Nov. 1851; d. Tangerine, Fla., 5 Jan. 1915. He was graduated from Muhlenberg College, Allentown, Pa., in 1869, from the Lutheran Theological Seminary, Philadelphia, in 1873, and after being ordained to the ministry was pastor at Phillipsburg, N. J., 1873–78, and at Philadelphia 1878–82. He was professor of English, history and logic at Muhlenberg in 1875–77, and in 1882–91 was professor of dogmatics and exegesis at Augustana Theological Seminary, Rock Island, Ill. In the last-named year he accepted the presidency and the chair of dogmatic theology at the Chicago Lutheran Theological Seminary. He published 'Commentary on the Gospel of Mark' (1881); 'Biblical Theology of the Old Testament' (1886); 'Annotations on the General Epistles' (1897); 'Theologia; or the Doctrine of God' (1903); 'Studies in Exodus' (1903), etc.

WEIGALL, Arthur Edward Pearse Brome, English Egyptologist: b. 20 Nov. 1880. He studied at Wellington College and at New College, Oxford, but from the age of 18 was engaged in archæological investigation. He was assistant to Petrie at Abydos in 1901–02; was engaged in excavations at Sakkárah in 1902–04; and excavated the mortuary temple of Thothmes III at Thebes in 1905. He was appointed inspector of antiquities under the Egyptian government in 1905, and held that office until 1914, when he retired. He investigated the antiquites of Nubia in 1906–07; later explored the eastern desert, the Imperial Porphry quarries, Wady Hammanat and Kassair; and in 1907–12 he was associated with the excavation and preservation of the tombs of the nobles of Thebes. Upon his return to London after his retirement in 1914 he became interested in designing stage scenery and costumes, in which vocation he has had considerable success; and he was part author of the play 'See-Saw' (1916). Author of 'A Report on the Antiquities of Lower Nubia' (1907); 'A Catalogue of the Weights and Balances of the Cairo Museum' (1908); 'A Guide to the Antiquities of Upper Egypt' (1910); 'The Treasury of Ancient Egypt' (1910); 'History of Events in Egypt from 1798 to 1914' (1915), etc.

WEIGAND, vī'gānt, **August,** Belgian musician: b. Belgium; d. Oswego, N. Y., 26 May 1904. He began his musical career as organist of Saint Giles' Church, Liège, and subsequently long presided at the organ of the Sydney, New South Wales, town-hall, then the largest instrument in the world. His achievements as organist and composer won for him a professorship in the Royal Conservatoire at Liège. He came to the United States in 1903, gave numerous concerts, opened the large organ at Brown University and was appointed to open the grand organ at the Louisiana Purchase Exposition, Saint Louis, in June 1904. In a dozen years he gave throughout Europe more than 1,800 concerts. He was the recipient of various distinctions, and was generally known as Chevalier Weigand.

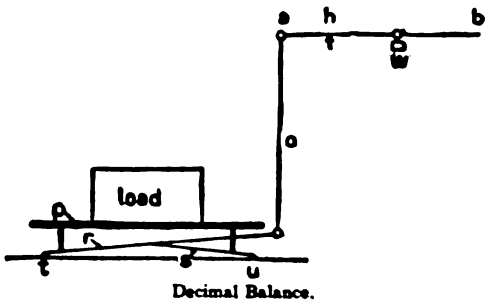
WEIGHING MACHINES, mechanical devices for ascertaining the weight of objects. It is to be understood, however, that the element thus determined is a relative value, and is entirely independent of the magnitude of the force of gravity or the tendency of a body to fall. It is measured at sea-level and at the

mean diameter of the earth. For example, the force of gravity decreases with elevation, but a commercial unit of weight such as a "pound" is the same at the top as it is at the foot of a mountain. In the usual method of determining weights of this character, a "unit of weight" is first adopted, and then a "set of weights" procured, each of which represents a certain predetermined number of the units. With these, by the aid of a machine so constructed as to be capable of establishing an equilibrium between any number of the weights and the article being weighed, the ratio of the weight of the article to that of the adopted unit is determined. Such machines may be conveniently arranged in three general classes—"equal armed" balances, "unequal armed" balances, and "spring" balances.

Equal armed balances are represented by the various forms of "scale-beams," in which the scale-pans hang below the beam, and the "counter-scales" in which the scale-pans are above the beam, both forms operating by adjustment of equilibrium between a known and an unknown weight. Unequal armed balances are represented by those consisting of a single steelyard, and those formed by combinations of unequal armed levers and steelyards, such as platform scales and weighbridges, in which a small known weight at one end of a beam counterbalances a heavy unknown weight at the other end. Spring balances operate on the principle that, when a helix is subjected to a tension, the amount of elongation increases proportionally with the increase in the force of tension. In the simplest form, it consists of a helical spring of hard steel of a high elastic limit. As commonly used it is suspended from a fixed point by a hook at its upper end, while its lower end is bent into a hook, which is crossed by another hook to which the article to be weighed is attached. An index attached to the spring and moving along the face of a graduated plate indicates the amount of tension in terms of the adopted unit of weight. The contrivance is so arranged that the axis of the spiral is always a plumb line, under tension or at rest, and is capable of weighing only an amount within the elastic limit of the spring. The capacity of such balances is generally small, and they are extensively used in shops, and for other purposes where a high degree of accuracy such as may be obtained by lever balances is not required. On the other hand, the various forms of dynamometers employed for registering the pull of locomotives are made with enormous capacities. In this connection the "torsion balance" may be conveniently mentioned, although in reality it is a machine generally used for the purpose of measuring horizontal forces, rather than weights as here understood. In its simplest form it consists of a beam, supported by a wire stretched horizontally which passes through its centre of gravity. When twisted by the application of a weight to the beam, the elasticity of the wire acts the part played by the weight of the beam in an ordinary balance. For measuring horizontal deflections caused by electric, magnetic, and other forces, the wire is stretched vertically.

For all forms of weighing machines of the equal armed type with small capacities, such as counter-scales, chemical and assay balances, etc., see BALANCE.

The majority of the machines of large capacity known as "platform-scales," used for weighing heavy loads such as carts loaded with grain, hay, coal, building materials, etc., operate on the principle of the lever, and belong to the class designated as unequal-armed balances. They are sometimes arranged as "decimal balances," the ratio between the small known weight on the weighing beam and the unknown weight on the platform or bridge being indicated in multiples of 10. Such a balance consists of a lever (ab), suspended at (h), and connected by the rod (o), with two levers (r) and (s), hinged at (t) and (u), respectively. A platform (p), resting by means of standards upon the levers (r) and (s), accommodates the load which is counterbalanced on the long arm of the weighing beam or lever (ab), by a sliding weight—(w). When a load is placed upon the platform (p), the levers (r) and



Decimal Balance.

(s), are depressed, and exert a downward pull on the short arm of the weighing beam through the rod (o), with a consequent lifting of the long arm. This pull is counterbalanced by sliding the weight (w) along the long arm until it is brought into a horizontal position. The weighing beam being graduated with an adopted unit of weight and fractions thereof (usually pounds), the weight of the load on the platform is ascertained by a simple direct reading of the graduated scale. In the smaller scales, the weight (w) equals one pound, and counterbalances a load of 100 pounds upon the platform, but it is evident, that by varying the number of levers and the relative lengths of their arms, any desired ratio between the load and the counter weight may be readily obtained. In scales used for weighing loaded wagons and cars, the ratio varies from one to 500, or one to 1,000. Cattle scales are capable of weighing from 10 to 200 head of cattle at a single operation, and the capacity of grain scales ranges upward of 500 bushels, while the large iron and steel manufacturing plants and gun shops employ machines with capacities exceeding 100,000 pounds. The machine at Watervliet Arsenal, Watervliet, N. Y., used for weighing guns, has a capacity of 300,000 pounds.

With the advent of the automobile and its far greater capacity of burden the platform-scales formerly used to weigh loads drawn by horses have become obsolete, and with the rebuilding of such weighing machines automatic recording devices have been added, so that a modern scales of this class will weigh a load of coal approximating five tons within the

limit of error of three ounces, and print the correct weight upon a tape without the services of any attendant.

Self-discharging scales are also much in use for measuring units of weight; as for instance the filling of packages of commodities, as coffee, suger, flour, cereals, etc. The same idea is embodied in receiving scales in large establishments, where coal, feed-water, sand, cement, ore, crushed stone, etc., are weighed as delivered, the receiving hopper discharging when the weight equals one ton, 100 pounds, or any other desired amount.

Railroad or track-scales are of prodigious size and capacity. The largest of this type in the world is a "suspended-platform" scales in the West Albany yard of the New York Central Railroad. The weighing rail is 90 feet long, and the capacity is 825 tons.

A new idea in heavy-work scale construction is known as the flexure-plate scale. In this type thin plate fulcrums of chrome-vanadium-steel take the place of the usual knife-edge pivots. They operate by bending instead of frictional movement on bearings. They have been found of most dependable accuracy and unequaled endurance, being unaffected by dampness or changes of temperature, and thus entirely free from the variations common to the ordinary track-scales.

The conveyor scale weighs material as it passes on a conveyor belt making use of electricity instead of weights for the recording. The belt is so arranged in reference to the weighing apparatus that the full belt is weighed against the empty return belt. A vertical plunger in a tube partly filled with mercury rises and falls in the tube according to the weight of material passing. The moving mercury brings more contact points into action the greater the thrust of the plunger, and the varying current makes its record automatically on a traveling tape. A standard comparison of amperes per hour and tons per hour gives the figure by which the weight is readily computed.

The computing scale is a machine which carries an attachment for indicating a certain limited range of prices. Usually it carries a cylinder covered with a paper roll ruled in many different proportions, each ruling indicative of a certain price unit. The cylinder turns with the weight, thus showing the cost at several different prices per pound.

The difficulty of exactitude in weighing is recognized and a legal "tolerance," as it is called, is permitted, within which no one can be accused of dishonesty or fraud. These tolerances are as follows: On counterpoise scales, one grain on one-fourth ounce; two grains on one ounce; 10 grains on 10 ounces; 10 grains on one pound; 40 grains on 10 pounds; 100 grains on 50 pounds. On platform scales one ounce is allowed on 50 pounds; one pound on 800 pounds; two pounds on one ton. On railroad or track-scales the permissible error is four pounds per ton.

WEIGHT THERMOMETER. See THERMOMETER

WEIGHTS AND MEASURES. Weights and measures are fundamental necessities of commerce, industry and science. Measurement is required in the exploration of lands and waterways, in their location and transfer, in the work of construction of buildings, bridges, railroads and other engineering works, in the manufacture of foods, in the preparation of compounds and in the purchase, shaping and sale of materials. Weights and measures are essential to all barter of goods. Here, the accuracy may range from the "heap" or "pile" of ancient times to the one one-hundredth of a cent used in cotton and spelter quotations "on change," estimates of value which we call prices being based on a specified weight of gold. Weights and measures are essential in all construction whether the precision be the "rule of thumb," or the millionth of an inch in optical work, or the one-ten-thousandth of an inch in the manufacture of fine machinery. The pharmacist with his weights compounds the prescriptions which mean health and life to the sick. In the extractive and compounding industries, weights and measures are used to determine the essential proportions in analyses and compounds, and precision is the main condition of reproducibility of results. Likewise the manufacturer must accurately weigh, measure and test his materials to secure perfect construction. Surveying and navigation would be very primitive were it not for the rigorous measurements of base lines, accurate triangulation, precise leveling, including even such delicate measurements as the variation of latitude. Weights and measurements will in fact be found necessary in the discovery and in the statement of industrial and scientific facts of all kinds. The birth of the exact sciences was coincident with the development and application of quantitative measurements to the phenomena of nature, and the rapid growth of modern science has since been parallel with that of precision. James Watt was one of the earliest to suggest international standards which would enable scientific results when published in terms of such standards to be intelligible and reproducible the world over. Precise and uniform standards made possible the interchangeability of parts in machinery, first practically applied by Eli Whitney and to-day one of the most important principles in manufacturing.

Classification.— Weights and measures ordinarily include those defining length, area, volume, capacity and weight. These are relatively the most important measures used by man. However, within the last half century when such products as power, electric current, heat, light, refrigeration and services or other kinds have entered the world's markets as commodities for manufacture, purchase and sale — the scope of weights and measures has widened to include units used in the measurement of velocity, pressure, energy, electricity, temperature and illumination. Technical requirements also resulted in a series of compound units such as the knot, a unit of speed for vessels of one minute of the earth's circumference per hour; the ton-mile used in transportation rates and statistics; the foot-pound, a unit of energy; the dyne, the international unit of force and other units of the centimetre-gram-second system of scientific units in use throughout the world. Such compound units are multiplying apace with the technical needs, and have proven of inestimable value and economy by the facility and precision which they afford in conveying exact quantitative results of experiment and observation. With advancing needs the units of weight

and measure have extended to microscopic and to telescopic dimensions. The millimicron of the physicist and the still smaller Angstroem unit of which it requires 254,000,500 to make one inch, are used in spectrum analysis for measuring the dimensions of light waves, while on the other hand the "earth's orbit" (meaning the mean radius of the orbit) is used by astronomers in measuring stellar distances. In addition, the "light-year" is used for the greatest distances, this unit being the distance which light traverses in one year, or about 6,000,000,000,000 miles. With the extension and division in size of units, the kinds of instruments utilized and methods of application of the units themselves have multiplied. Almost every occupation has its particular units, its methods of making measurements and its special measuring instruments. A few of the thousands of the latter may be cited, such as the common desk rulers, carpenter's folding rules, draughtsman's scales, surveyor's chains, engineer's tapes and level rods, lumberman's log rules and board measures, the merchant's yard stick, the tailor's tape, the shoe, glove and hat-measures, machinist's scales, measuring bars, micrometers, micrometer calipers, limit gauges of ring and plug types, end and line standards of precision. In measuring volume we have the standard capacity measures, milk measures, beer measures, wooden dry measures, a vast variety of standard flasks, glass graduates such as burettes, pipettes and other volumetric apparatus of the druggist, physicist and chemist, the gauging rods for casks and cargoes, gasometers reading in cubic feet, tanks and reservoirs with graduated scales reading volumes directly. For weighing, we have even-balance scales, steelyards, platform scales, spring balances, all ranging from the most delicate analytical balances to the master scales for weighing canal boats and railway trains. Scales are especially designed for every particular need, and the countless varieties attest the high state of the art of weighing and its great importance in industrial and scientific work. Such instruments have multiplied in form and number and the demand for them has grown so rapidly that the manufacture of weights, measures and measuring instruments forms in itself a whole group of industries.

With the development of units of measure of the order of inter-molecular distances on the one hand and of almost interstellar distances on the other, and the multiplication of kinds of instruments used in measurement has come the invention of a large variety of measuring appliances which automatically indicate the result upon a scale. Of this class are thermometers, spring balances, aneroid barometers, pressure gauges, speedometers and indicating meters of all kinds. Computing scales not only indicate the weight but show the computed total price of the article at several prices per pound. Many of this class of instruments also make continuous record of the measurements showing by a curve the values at successive moments of time. Of this type are the automatic recording instruments used to record temperature, air pressure, sunshine, rainfall, electrical quantities as well as tide recorders, anemometers and many others. Equally interesting are those measuring instruments like dividing engines, trip scales or trip measures which besides measuring definite lengths, weights or quantities automatically perform certain operations, such as graduating a scale, delivering or tipping a certain weight of grain, or delivering certain volumes of liquids. Closely related are those devices which integrate quantities delivered or magnitudes measured, such as the small map wheels which measure distances on maps, or the planimeters which measure areas within irregular contours, and all forms of gas and water meters, integrating rain gauges, integrating watt meters for measuring electric power consumed. These instruments usually indicate on a dial the total number of units measured since the last zero setting.

Metrology.— Many sciences and industries have given the science of metrology their best thought and labors. Chemistry opened up new chapters in the science of the refractory metals, developing iridium and platinum of purity requisite for the world's fundamental standards of mass and length, producing in conjunction with metallurgy the remarkable nickel-steel alloy "invar" (q.v.), having practically a zero temperature coefficient of expansion; the alloy manganin free from temperature coefficient for electrical resistance; Jena glass, a material for measuring flasks and thermometer bulbs which practically eliminates temperature disturbances. To optics and the glass industry we are indebted for the microscopes, telescopes, polariscopes and other optical instruments which form essential parts of modern measuring apparatus. Optical methods based upon the interference of light waves have made possible the detection of changes of dimension far beyond the power of the microscope to detect. By such methods plane glass surfaces are produced having errors of less than a millionth of an inch, and in the interferometer is provided the most delicate and senstive length-measuring instrument known to man. Metallurgy and engineering have developed methods of fusing, casting and tempering materials to be used in measuring apparatus, and have developed the accurate machining of such instruments. Astronomy has given the precision measurements of time, the "second" being the unit of time in the international C. G. S. system of units. Mathematics has devoted a large section of its science to the theory of observations and added rigor in their adjustment, and in the elimination of accidental errors, and by developing the theoretical side of precision measurements has rendered the greatest service to metrology.

Unit Standards.— The standards of length and mass are fundamental. From these and the unit of time practically all other standards are derived, either directly or indirectly. The derived standards include those used in the measurement of volume, density, capacity, velocity, pressure, energy, electricity, temperature, illumination and the like. The production of copies, multiples and subdivisions of the fundamental standards, the construction of the derived standards, and the comparison of the standards used in scientific work, manufacturing and commerce with the fundamental or derived standards of the government are functions of the Bureau of Standards in the United States and of similar bureaus in other countries. In the United States the standard of the weights and measures of trade is maintained through the State, county and city sealers

of weights and measures with an efficiency dependent upon local administration. For more precise purposes, however, uniformity and precision are attained and maintained only by regular reference of the local standards to the fundamental standards of the government, at the Bureau of Standards in Washington.

The units of weight and measure in the United States are practically those used in the colonies prior to the formation of our government. While Congress has never definitely authorized the weights and measures in common use, it has sanctioned their use by its act of 14 June 1836, providing that accurate copies of the yard, pound, etc., be furnished as standards to each State of the Union. The constitutional power "to fix the standard of weights and measures," vested in Congress (I. 3, ¶ 5, United States Constitution) has rarely been exercised, so that legislation on weights and measures has been confined to the individual States, and in this manner numerous differences in usage have grown up in the several States, although the same general system of weights and measures prevails throughout the country. The customary units of length are defined by reference to the yard. The yard itself was formerly defined as the length of a certain brass bar, the standard yard, kept at the Office of Standard Weights and Measures in Washington. Since 1893 the yard is defined in terms of the international metre. The yard appears to have been a unit of length in England since very early times. The name signified in Old English and in Anglo-Saxon (gyrd) a rod or stick. A standard bronze yard of 1496 still exists in England, having been used for the verification of other yards until 1588, when a new standard was made which is also in existence to-day. This yard, known as the Winchester standard, was the legal standard in England until 1824, when new standards, the imperial standards, were authorized.

When the Coast Survey was organized it was found necessary to have a definite standard of length, and an 82-inch bar was secured from the instrument maker, Troughton, of London. This bar was nearly a copy of Troughton's scale, and had not been compared with the British standard yard, but the distance between the 27th and 63d inch marks on the bar was taken as representing the standard yard, and was made the basis of the standards sent out in accordance with the act of Congress of 1836. In 1834 the British imperial yard was destroyed by fire and when a new standard had been prepared, copies of it were made, two of which were presented to the United States in 1856. These copies were compared with the Troughton scale, and the latter was found to be 0.00083 inch longer than the new imperial yard at the standard temperature of 62° F. One of the copies was then accepted as standard by the United States Office of Standard Weights and Measures in place of the Troughton scale. This copy of the imperial yard was the standard on which all measurements of length in the United States were thereafter based until 1893, when the yard was defined in terms of the international prototype metre. The matter had been left entirely to the Treasury Department, which had adopted different yards from time to time, assumed to be equal to the British imperial yard.

The copies of the imperial yard had shown noticeable changes relative to the standard when subsequently compared, and this led to the belief that the imperial yard itself was not constant. Shortly after the arrival of the national prototype metre, a careful determination of the relation of the imperial yard to the international metre at the Office of Standard Weights and Measures showed that the relation differed from that legalized in 1866 by less than the uncertainty of the comparison, and it was decided to adopt the metre as the fundamental standard of length and to define the yard in terms of it. Not only is the constancy of the length of the imperial yard suspected, but in addition the lines, which are about 1-1000 of an inch wide, are much too broad for present requirements. On the other hand, the international metre and its copies satisfy the rigorous requirements of modern metrology. The kilogram was also declared to be the fundamental standard of weight. The present standards of the United States are, therefore, independent of the British standards and in part differ from them. The prevalent idea that the weights and measures in common use are identical with the British imperial system is, therefore, erroneous. The United States yard is slightly longer than the imperial yard and this inequality extends to all of its subdivisions and multiples. The present material standards of the United States are the national prototype metre No. 27 and the national prototype kilogram No. 20, received by the President of the United States on 2 Jan. 1890. These are accurate copies of the international prototype metre and kilogram which are the fundamental standards of length and weight designed for the entire world. The latter standards are preserved at the International Bureau of Weights and Measures in accordance with the International Metric Convention of 1875, now signed by the leading countries of the world. These countries jointly maintain and direct the work of this bureau through official representatives forming an international committee, composed of eminent scientific men.

The units of length and the derived units of area, volume and capacity are derived from the international metre in the ratio of 1 metre = 39.37 inches (Law of 28 July 1866). Since 1893 the Office of Standard Weights and Measures and the Bureau of Standards which superseded that office have used the equivalent 1 yard = 3600/3937 metre (by order approved 5 April 1893). This action fixed the values, inasmuch as the reference standards are as perfect and unalterable as human skill could make them. Besides the yard, the units of length most universally employed in the United States at the present time are the inch, foot and mile.

The "inch" is the 1–36 part of the yard and like it has been in use since ancient times. The name (derived from the Latin *uncia*, meaning the 12th part) occurs in Anglo-Saxon in the form of ynce. It probably originated only as a convenient subdivision for the foot. Lengths shorter than one inch are commonly expressed in fractions of an inch. Two methods of subdivision are in common use; among builders and wood-workers it is customary to use the binary subdivisions, half quarter, eighth, etc., but machinists also divide the inch into

tenths, hundredths and thousandths. The inch is usually denoted by the symbol "; but botanists use the symbol ' for the inch. The "miner's inch" is a rather vague unit for the flow of water varying from 1.36 to 1.73 cubic feet per minute, and is the flow of water through a single square inch of orifice under varying heads of water. The "inch or gauge of cream" is fixed by Iowa statute as equal to one-half gallon.

The "foot" is legally defined as one-third of the yard or 12 inches. As its name implies it was probably based on the length of the human foot. Almost every nation, ancient and modern, has had a unit called the "foot," its value differing somewhat, as might be expected with a unit of so crude an origin. Most countries, however, have now adopted the metric system, the foot being discarded as an official measure, though universally used in English countries. Lengths shorter than one foot are usually expressed in inches and fractions of an inch, but among surveyors and civil engineers it is quite common to use decimal fractions of the foot. The foot is generally denoted by the symbol ', but botanists use the symbol ° to denote feet. Some artisans use the foot and the inch but not the yard, others the yard and its binary divisions, but not the foot or inch. Thus the foot and inch are used to the exclusion of the yard in building, while the yard and its binary subdivisions to the exclusion of the foot and inch in measuring cloth.

The "statute" or "land mile" is the unit most commonly used for longer distances and is equal to 5,280 feet. The name is from the Latin *mille passuum*, 1,000 paces, the Roman pace being a double step and consequently about five feet in length. This mile was used by the Anglo-Saxons. Almost every European nation has had a unit called the "mile" but widely at variance with one another, ranging from about two-thirds of the United States mile (Holland) up to seven United States miles (Norway). The old British statute mile was about 300 feet shorter than the United States mile but now is the same.

The following units of length are used in special work and are arranged in the order of their magnitude. Metric units are not included, as they are for the most part official only, and not generally in use in commercial and industrial life. See METRIC SYSTEM.

Mil (.001 inch) is used in electrical work, especially in indicating the cross section of wires.

The point (1-72 inch) is used in designating the sizes of type, the point system designating the sizes of type by the number of seventy-seconds of an inch height of the type face. The em is a unit of measure used in composition and varies with the size of the type, usually being considered as the square of the face height.

The line (1-12 inch) is little used, mechanics preferring to divide the inch into tenths, hundredths and thousandths. It is used by printers and by botanists, the latter denoting the line by the symbol ". The line "button measure" is 1-40 inch as defined in the tariff act.

The barleycorn (one-third inch) is an old unit still surviving in shoemakers' shoe sizes, these being graded by thirds of an inch or barleycorns, in a system of 13s.

Four units based upon the "hand" are sometimes used. These are the nail (two and one-fourth inches) for measuring cloth, originally the distance from the end of the thumb nail to the joint at the base of the thumb, and later fixed as 1-16 yard; the palm (three inches) includes the breadth of the hand exclusive of the thumb; the hand (four inches), originally the breadth of the palm, is used in measuring horses and is almost exactly one decimetre; the finger (four and one-half inches) is about the length of the middle finger and is only used as a rough unit in cloth measure. This should not be confused with the finger breadth used in measuring charges of powder.

The surveyor's link (7.92 inches) is the length of one link or 1-100 part of a surveyor's chain, and is used in the survey of lands.

Quarter (nine inches) is sometimes used in measuring cloth (more frequently in Great Britain) to designate a quarter of a yard. A unit of the same length called the span was originally half a cubit, but probably has not been used in modern times as an officially recognized unit.

The engineers' link (12 inches) used as a unit in engineering is the hundredth part of the engineers' chain and is decimally divided. The 10th of the engineers' link is 1.2 inches.

The pace is a conventional unit for measuring distances and is the length of a stride measured from the heel of one foot to that of the other; a full pace measures about one yard. This is the value of the United States military pace, double time, with a cadence of three steps a second. The regulation military pace quick time is 30 inches with a cadence of two steps per second. The Roman pace was a double step of about five feet.

The English ell, a unit still referred to but seldom used, having a value of 45 inches, varying, however, in different places. The Flemish ell of 27 inches is still in use commercially in the Low Countries.

The fathom (six feet) is used in measuring depths of water or mines. The name comes from an Anglo-Saxon word faethm, signifying "embrace," and originally meant the length of rope between the two hands when the arms were held outstretched.

The rod, perch or pole is equal to five and one-half yards and is used in measuring land. It has varied in different places from five to eight yards and is supposed to have been the length of the ancient goad used to measure the width of the first furrow.

The surveyors' or Gunter's chain (22 yards) was so chosen that 10 chains square might exactly equal one acre. This chain is the official unit prescribed formerly for the use of surveyors surveying public lands under the supervision of the surveyor-general and now often used in relocating old surveys.

The engineers' chain (100 feet) is used in engineering, and is decimally divided into feet, tenths and hundredths of a foot. The use of the two chains in many cases for the same land for different purposes requires reduction tables. On account of the direct relation to the foot, the engineers' chain is becoming very widely used.

The bolt for measuring cloth is generally given as 40 yards, though the name means simply a roll of definite length. The customary

length of the bolt varies with different fabrics and manufacturers.

The skein for yarn is often defined as 120 yards. Its length varies, however, according to the material and the locality. Consult the United States Conditioning and Testing Company's 'Textile Tables' (New York 1914).

The United States cable's length (720 feet), used by mariners, is 120 fathoms as recognized by the United States navy.

The furlong (220 yards) originally meant "length of a furrow," supposed to be the distance oxen could plow without stopping to rest.

The hank is a unit of length for yarn. In the United States the length of a hank of cotton is usually 840 yards, while that of linen is 3,000 yards; different lengths, however, are also in use under that title.

The nautical mile or geographical mile has been defined as 1-60 part of the length of a degree of a great circle of the earth. Since the earth is not a perfect sphere, however, the degree varies in length and this has led to much confusion in usage regarding the nautical mile. The definition accepted by the United States Coast and Geodetic Survey (consult Report of 1881, Appendix 12) is as follows: The 1-60 part of the length of a degree on the great circle of a sphere whose surface is equal to the surface of the earth. This makes the length of the nautical mile 6,080.20 feet or 1,853.248 metres. The uncertainty in the dimensions of the earth affects the last decimal place given. The nautical mile is often miscalled "knot." The latter term, however, is not a measure of length, but a measure of speed, equal to one nautical mile per hour. The admiralty "knot" of Great Britain is 6,080 feet.

The league is equal to three miles, the land league being equal to three United States statute miles (15,840 feet) and the United States marine league to three nautical miles (18,240.6 feet). Its value varies in different countries. The marine league is the distance from shore over which a country has jurisdiction under international law.

The degree is equal to about 60 nautical miles.

The astronomical unit, equal to the mean radius of the earth's orbit or nearly 93,000,000 miles, is sometimes used in stating astronomical distances.

In stating interstellar distances it is sometimes found convenient by astronomers to use the light year, being the distance traversed by light in one year, or 65,700 astronomical units.

Besides the measures of length given above, there are numerous very special methods of denoting length in case of special commodities. The thickness of sheet iron and steel is denoted by a system of arbitrary gauge numbers. The numbers in use differ for different products. On 3 March 1893 Congress passed an act establishing a standard gauge for sheet and plate iron and steel for use in the customs service. In this system the gauge numbers indicate thickness, or the weight per unit area. Sizes of wire are also denoted by a special system of arbitrary gauge numbers. The number of different systems which have been used is quite large. Pfeilschmidt's 'Wire and Sheet Gauges of the World' gives comparative tables for 11 systems of wire gauges. At present the most common gauges in use in this country are the Brown and Sharp gauge and the Birmingham wire gauge. (See WIRE). The fineness or coarseness of yarn is denoted by a system of numbers, called "counts" which indicate usually the number of hanks of the yarn in question which will weigh one pound. Thus No. 10 yarn (English cotton yarn and spun silk count) is a yarn of such fineness that 10 hanks (of 84,000 yards) are required to make a weight of one pound, or again No. 1 wool (Aberdeen count) is such that one spindle (of 14,400 yards) shall weigh a pound. There are about 24 different systems of counts in use, and in order to introduce uniformity in counting textile yarn throughout the world, the international metric count was approved by the International Paris Conference of 1900. According to this count, No. 1 means that a length of 1 metre will weigh 1 gram, and 100 metres of No. 100 yarn will weigh 1 gram.

In addition to the above there are a large number of special systems of numbering particular commodities such as hats, shoes, gloves, nails, cordage, books and other articles, too numerous for description.

The units of superficial measure or area are usually the squares of the linear units and as such need but little comment. The circular mil (.7854 square mil) is the area of a circle .001 inch in diameter. One circular inch contains 1,000,000 circular mils, and one square inch contains 1,273,240 circular mils. The square inch is the most common small unit of area, being used in measuring pressures, strength and other properties of materials, and in engraving, cloth analysis and many other purposes. The square foot (144 square inches) is also largely used. It is the basis of the board foot which is 144 cubic inches of undressed lumber, being reckoned as one square foot of one inch board, or its equivalent. The "square" is a unit used in carpentry for flooring, ceiling and shingling, and contains 100 square feet, architects' and builders' measure.

In surveyors' measure 1 acre = 10 square chains = 160 square poles = 100,000 square Gunter's or surveyors' links. The acre (43,560 square feet) was probably as much land as could be tilled in a day and therefore of rather indefinite extent until later times. It is a unit of the same order as the French *journée* and the German *Morgen*. The acres of various countries differ in size, for example, the Irish acre of 7,840 square yards; the Scottish acre of 6,104 square yards; the Cheshire acre of 10,240 square yards; Cunningham acre and the Imperial acre.

In subdividing public lands in the United States, the lands are laid out in townships. One township = 36 sections or square miles = 144 quarter sections = 23,040 acres. The "homestead" is a free grant of public land having a maximum area of one-quarter section or 160 acres. In the Philippine Islands, the "homestead" is 64 hectares, which is almost identical with the homestead as defined above.

Among the more important units of volume are the cubic inch, the cubic foot, the cubic yard, and the cubic mile. The cubic inch is practically the smallest unit of volume based directly on linear units. It is very largely used. The cubic foot (1,728 cubic inches) is used in engineering to express volumes of gas, water, or other solids. In some States, such as Wash-

ington and Colorado, the cubic foot is established by statute as the legal unit for measuring the volume of water. A special system of units is used in the measurement of wood; 144 cubic inches or one foot square of one inch board is expressed as one board foot. A timber foot, however, is 1,728 cubic inches or one cubic foot. A cord foot is a pile of wood 1 by 4 by 4 feet. A cord of wood is 8 cord feet. In the lumber business boards are usually bought and sold by the 1,000 board feet to simplify computation. In New Hampshire, a measure for lumber was adopted in 1866 based upon an "imaginary cubic foot" equal to about 1.4 cubic feet. This unit is also used in parts of Maine and Vermont. Round timber is measured as follows: "A stick of timber 16 inches in diameter and 12 inches in length shall constitute one cubic foot, and the same ratio shall apply to any other size and quantity. Each cubic foot shall constitute 10 feet of 1,000 board feet." In the practical use of this rule it is customary to consider 115 cubic feet equivalent to 1 000 board feet, instead of 100 cubic feet, according to the wording of the statute. In this case the diameter is taken at the middle of the log inside the bark. If the diameter is measured at the small end of the log, 106 cubic feet are allowed for 1,000 board feet. The New Hampshire rule is called the Blodgett Rule. The Doyle is the standard of log measurement in Arkansas for logs cut and sold or hauled. A large variety of log rules is in use throughout the country. These are locally accepted as standards, but they differ among themselves in so confusing a manner as to make it impossible to give an accurate and complete statement concerning them. The cubic yard is used largely in engineering and in computing grading, cuts and fills, a cubic yard being equal to about one load.

The perch, in addition to being a unit of length and a unit of area, is also widely used as a unit of volume of brickwork and masonry. The perch of brickwork, however, is a widely varying unit, ranging from 16½ cubic feet to 25 cubic feet. In Colorado it is 16½ cubic feet, in Philadelphia 22 cubic feet, 25 cubic feet in North and South Dakota, 24¾ cubic feet in other places. The latter perch is equal to a section of brickwork 1 by 1½ feet by 16½ feet or one perch in length.

A cord of masonry is usually reckoned at 100 cubic feet, although in some cases it is 96 cubic feet.

The cubic mile is used in expressing very large volumes, such as the silt carried by rivers.

Liquid Measure.— The fundamental unit of liquid measures in the United States is the wine gallon of 231 cubic inches — a unit abandoned by England in 1824, but now generally adopted by the various States of the Union. The British Imperial gallon measures 277.274 cubic inches, and is the volume of 10 pounds of water at 62° F. The liquid measures of the United States unfortunately bear no relation to those of England. Much confusion is occasioned by the use of the ambiguous term gallon, as there are in the United States the wine gallon (231 cubic inches), the ale, beer or milk gallon (282 cubic inches), and the dry gallon, besides the "proof gallon," the unit for internal revenue taxation. The "proof gallon" is a wine gallon of spirits containing one-half its volume of nearly pure alcohol at 60° F. and is the basis for computing the United States internal revenue tax. For example, a gallon of spirits containing 40 per cent alcohol would be 80 per cent proof and the number of proof gallons is computed by multiplying the per cent of proof by the number of wine gallons. Wisconsin and Connecticut still retain the dry gallon of 282 cubic inches as a legal standard. New Hampshire and Minnesota definitely retain the ale, beer or milk gallon of 282 cubic inches, and Maine definitely mentions the same unit among its list of State standards. A Minnesota statute provides that the "Beer and milk measures shall contain the following capacities: The gallon shall contain 282 cubic inches. The half gallon shall contain 141 cubic inches, and the quart one-half as much, and the pint one-half as much as the quart." The milk gallon thus established is 51 cubic inches larger than the standard gallon used more generally throughout the country. There are thus three different quarts, the dry quart derived from the Winchester bushel, the liquid quart derived from the wine gallon, and the liquid quart derived from the beer or milk gallon. The differences, of course, extend proportionately to all the multiples and subdivisions of these units. The ordinary liquid measures are usually 1 gallon = 4 quarts = 8 pints = 32 gills. In addition to the capacity measurement by volume, the legal weight of a gallon of certain commodities have been fixed by statute in some States, and in several cases by Congress for certain purposes. Thus 12 pounds of strained honey is a legal gallon in Nebraska, 6½ pounds of kerosene (Kansas), and 7½ pounds of kerosene in Ohio, 11 pounds of sorghum molasses (Indiana), 11 pounds of maple syrup (New York), 8 pounds of castor oil (Kansas) are all legal gallons of the products named. These legal weights differ among themselves, and do not accord with the true volume of one gallon of 231 cubic inches.

The subdivisions of the gallon, the quart, pint and gill are largely used in trade. In addition to the general liquid measures enumerated above, apothecaries have a special system of capacity measures based on the volume of the United States liquid pint of 28.875 cubic inches. One pint = 16 United States fluid ounces = 128 United States fluid drams = 7,680 United States minims.

The minim is the smallest of the United States units of volume and is about 0.00376 cubic inches. A minim of pure water weighs about 0.95 grains and corresponds to the "drop," which it approximates in size. The United States minim is about 4 per cent larger than the British Imperial minim. It is denoted by the symbol ℥.

The drop varies from 0.02 to 0.1 cubic centimetre and is not a fixed unit, but is convenient for use in dispensing very small quantities of liquids. It is not subdivided and its size depends upon the liquid and the method of dropping. The ordinary form of drop pipette of the ophthalmologist delivers drops of about a half United States minim.

The United States fluid dram (60 minims) is equal to one-eighth United States fluid ounce, its volume differing from the volume of one avoirdupois dram of water, from the volume of

one apothecaries' dram of water (by weight), and is about 4 per cent larger than the fluid dram in use in Great Britain. It is about 4 cubic centimetres, or an average teaspoonful, and is denoted by the symbol *f3*.

The United States fluid ounce (480 United States minims) is the 1-16 part of the wine pint and has a volume of about 1.8 cubic inches. It differs from the British unit of the same name as well as from the volume of the avoirdupois ounce of water and the troy or apothecaries' ounce of water. Other measures of less definite character are often found convenient, such as the teaspoonful, dessertspoonful, tablespoonful, wineglassful and teacupful. They do not contain exactly the quantities usually given arbitrarily, but more exactly the common spoonfuls contain the following quantities: A tablespoonful, 5 fluid drams or 20 cc.; a dessertspoonful, 2 fluid drams or 10 cc.; a teaspoonful, 60 minims or 5 cc.

Dry Measures.— The dry measures in general use in the United States bear no direct relation to the liquid measures of this country or Great Britain. The following are the ordinary units of dry measures: One bushel = 4 pecks = 32 dry quarts = 64 dry pints. The fundamental unit is the Winchester bushel, a unit abandoned by England in 1824. The Winchester bushel had a capacity of 2,178 cubic inches. In the United States the name Winchester has been attached to the London bushel with a volume of 2,150.42 cubic inches and is about 69 cubic inches or 3 per cent smaller than the Imperial bushel of Great Britain — a proportionate difference existing in the subdivisions of the bushel. Conflicting State laws render difficult an adequate statement of the status of the "bushel" in this country. Although the standard Winchester bushel contains 2,150.42 cubic inches, Nebraska has established 2,150 cubic inches as the volume of a legal bushed for that State, and other States have made similar changes. Several States adopted the old ale or milk gallon as the capacity of the dry gallon, this being about 5 per cent larger than the corresponding unit derived from the Winchester bushel. Moreover, special bushels have been legally established in many States for particular products, such as the charcoal bushel, which in Connecticut is 2,748 cubic inches, in Colorado 2,500 cubic inches, in Kansas 2 564 cubic inches, in Pennsylvania 2,571 cubic inches and in Minnesota 2,419.5 cubic inches (or ½ basket). In Vermont "one bushel and three-quarters of a peck" are "deemed a bushel of charcoal, lime, or ashes." In some places five pecks constitute a bushel of "screened lump coal." A lime bushel in Minnesota is 2,688 cubic inches. In Pennsylvania, however, it is equal to the Winchester bushel, although the coke bushel is 2,648 cubic inches. In the adjoining State of Ohio the coke bushel is 2,688 cubic inches. In Idaho, the bushel of fruit is defined as 2,564 cubic inches and in Missouri as 2,680 cubic inches. Some States require, furthermore, "heaped measure," others "struck measure," the heap sometimes being required to be "as high as the article will admit," and elsewhere "as high as may be without special effort or design," and in still other cases, as in Connecticut, the heaped bushel is definitely fixed as 2,564 cubic inches. The many objections to buying and selling agricultural products by volume, such as the difficulty of detecting error or fraud, the variation in the size of the heap, the ease of packing short quantity in a given volume, the effects of expansion, moisture, or shaking and the general uncertainty of estimates of quantity based upon volume early led to the practice now quite general, of defining the bushels as definite weights for the different commodities. Unfortunately the matter was left to the several States with the result that the lack of uniformity in legislation and custom has introduced considerable confusion. Not only do the weights fail to equal the true volume of one Winchester bushel, but even for the same commodity and in adjoining States the values are widely at variance. In at least two cases the size of the bushel varies with the time of the year. For a few commodities like wheat and hard coal, the standard weight is fairly general — but for such commodities as fruits and vegetables there is but little uniformity. The values of the various bushels of apples vary by about 10 per cent and for beans and charcoal about the same proportion, the legal weights of the bushel of gooseberries or beets by about 20 per cent and for cranberries 17 per cent, for sweet potatoes and buckwheat the variation is about 28 per cent in range. The "bushel" has in fact become merely a name for a miscellaneous group of units varying from State to State and differing for the various commodities, sometimes as in at least two cases, changing with the time of the year. The uncertainty is confusing to trade and precludes the compilation of accurate statistics based upon so variable and ambiguous a term.

The barrel is a convenient receptacle for packing, transporting and storing commodities. It varies in size, sometimes being defined in terms of units of volume, 6,253¾ cubic inches struck measure in Massachusetts. In other cases it is fixed as a definite number of units of dry measure, 100 dry quarts in New York, five bushels in Tennessee; or in some States as a definite number of liquid gallons, 36 gallons in Arkansas, 42 gallons in Tennessee, or more commonly 31½ gallons. Besides this method of definition the barrel, like the bushel and the gallon, is legally defined for certain commodities in terms of a definite number of pounds. The barrel of flour, for example, is commonly fixed at 196 pounds. Apart from this, but few States have used this method of defining the barrel and that only for a few products. One hundred and eighty pounds of shelled corn constitute a legal barrel in Connecticut, 200 pounds of pork in Indiana, North Carolina and Tennessee, 200 pounds of fish in Maine, 150 pounds of sweet potatoes in Massachusetts and 3¼ bushels dry measure in Louisiana. In New York and some other States the several dimensions of the standard barrel are specified, although other forms containing the same volume may be used. The dimensions specified in New York are head diameter 17½ inches, stave length 28½ inches, bulge not to exceed 64 inches outside measure. A barrel of crude oil is usually 31½ United States wine gallons and the barrel of refined oil 42 gallons.

The hogshead (two barrels), the pipe (four barrels), and the tun (eight barrels) are more commonly not intended as definite measures but merely convenient receptacles for liquids in bulk.

The smaller units of dry measure, such as

the peck, dry quart and dry pint, are largely used in retail trade, the pint and quart being used for smaller products like berries.

Avoirdupois System.— The avoirdupois system of weights is used for almost all commodities except the precious metals, chemicals and jewels. The avoirdupois dram differs from the apothecaries' dram, and the avoirdupois ounce and pound differ from the troy units of the same name. Ambiguity is avoided only by properly qualifying the terms. The use of such unqualified terms as ounce, pound or ton causes great confusion owing to the uncertainty and ambiguity of the terms. The "avoirdupois pound" or "troy ounce," however, are definite units. The avoirdupois units are as follows:

One long ton = 20 long hundredweights = 80 long quarters = 2,240 pounds = 35,840 ounces = 573,440 drams = 15,680,000 grains.

One short ton = 20 short hundredweights = 80 short quarters = 2 000 pounds = 32,000 ounces = 512,000 drams = 14,000,000 grains.

The fundamental unit of the avoidupois system is the avoirdupois pound now derived from the International kilogram, in accordance with the law of 1866 and the executive order of 1893, the value being 453.5924277 grams, on the basis of 2.204621 pounds to the kilogram. The avoirdupois pound was probably derived from the Attic mina of 6845.3 grains troy, the 1-60 part of the large Attic talent, divided by the Romans into 16 ounces of nearly the same weight as the modern ounce. Congress has never directly legalized any standard of weight except the troy pound and that only for purposes of coinage. To avoid confusion in comparisons of mass, the ratio of the avoirdupois pound to the troy pound was fixed at 7,000 to 5,760, measured in grains.

The United States avoirdupois ram (or drachm) is the 1-16 part of the avoirdupois ounce (28.3495 grams). This unit must not be confused with the apothecaries' dram (weight) which is the one-eighth part of the apothecaries' ounce or 60 grains. The avoirdupois dram is largely used in the textile industries. The avoirdupois ounce is the 1/16 part of the pound and contains 16 drams. The avoirdupois stone is a denomination often used, especially in England, and varies with different commodities, the most common value being fixed in England as 14 pounds.

The hundredweight (cwt.) is the 1/20 part of the ton. The round hundredweight contains 100 pounds and is sometimes called the "cental," while the long hundredweight contains 112 pounds. This unit is used very largely in fixing transportation rates.

The commercial ton of 2,000 pounds is in very general use throughout the United States, but 112 pounds is the legal hundredweight in many places, and 2,240 pounds the legal ton, as in England. The gross ore ton contains 2 688 pounds. Some confusion exists in the use of the word "ton," as the unqualified term may mean the short ton, long ton, gross ore ton, miner's ton, varying from 2,500 to 3,000 pounds, displacement ton of 35 cubic feet, shipping ton of 40 cubic feet, timber ton of 42 cubic feet, or register ton of 100 cubic feet. The register ton varies in different countries. Accurate statistics covering more than a single State or industry are difficult to obtain, owing to the difference in the values of these units and methods of measurement. The tariff act defines the ton of coal as "28 bushels of 80 pounds each" equal to the long or United States ton, but the statutory ton of coal in Montana is defined as 26⅔ bushels of 76 pounds each. In some cases the ton is defined as a definite number of cubic feet, for example, 343 cubic feet is a legal ton of hay in North Dakota and Oklahoma, and in New Mexico the ton is defined as 380, 422, or 512 cubic feet, according to the time the hay has been stacked.

Troy Weights.— The troy weights are as follows: One pound = 12 ounces = 240 pennyweights = 5,760 grains. The troy pound was legalized in 1828 as the standard unit to be used by the Mint of the United States in the regulation of the coinage. In view of the confusion in the weights and measures of trade, Congress found it important to legalize some particular weight for the use of the Mint, and by the act of 19 May 1828 legalized the copy of the Imperial Standard troy pound. This copy was procured by Albert Gallatin in England in the preceding year and was received by President Adams 13 Oct. 1827. It was based upon the old Imperial Standard troy pound of 1758, legalized in 1825. This troy pound has not been recognized as a legal standard in England since 1855, and was declared illegal, with penalty attached, in 1878.

The grain is the 1-5760 part of the troy pound, and is the only unit which connects the troy system with the avoirdupois. A very old English statute (51 Henry III, 1266) provided that the English penny should weigh "thirty-two grains of wheat well dried and gathered out of the middle of the ear." Fifteen different values of the grain in different countries are cited, varying from 0.68 to 1.54 United States troy grains. The troy grain, as used in the United States, is 0.0648 gram. The diamond grain is 0.8 troy grain. The troy grain is practically obsolete in the avoirdupois measures. Fractions of the grain are usually indicated decimally.

The pennyweight is the 1-240 part of the troy pound. Some 18 different values are recorded, varying from 7.42 grams to 24 United States grains.

The troy ounce is the highest troy denomination permitted in England, and is used in stating quantities of silver and other precious metals. In assaying the troy ounce is frequently divided decimally. The silk troy ounce according to Troemner is the 1/16 of the troy pound and contains 360 grains. One hundred and seventy-five troy ounces equal about 192 avoirdupois ounces.

The units of apothecaries' weights are as follows: One apothecaries' pound = 12 ounces = 96 drams = 288 scruples = 5,760 grains. The apothecaries' pound is equivalent to the troy pound in the United States, but in England the apothecaries' weights based on the troy pound were discontinued in 1858 under authority of the medical act, and avoirdupois weights substituted in dispensing medicines. In the United States, the avoirdupois system is largely used in buying and selling drugs, although the metric system is rapidly coming into use and displacing the apothecaries' weights on account of its great convenience. The apothecaries' grain is used in compounding prescriptions of the more powerful drugs. The United

territory, was leased to Great Britain. The leased territory included the island of Liu Kung, all the islands in the bay and a belt of land 10 miles wide along the whole coast of the bay; area, 280 square miles; pop. 120,000; but the population of the town of Weihaiwei is only about 2,500 inhabitants, being an old-time walled town. By the terms of the lease Great Britain has sole jurisdiction within the limits of this territory, but within the walls of the city, Chinese officials may exercise such authority as is not inconsistent with the defense of the territory. The British government may also erect fortifications and carry out other defensive works in a defined region lying outside of the leased territory. Chinese war-vessels retain the right to use the waters. Weihaiwei is not to be fortified, but is intended to be a naval base, place of exercise and sanatorium for the British squadron on the China station. The station is used as a flying naval base, but no troops are stationed there, and the Chinese troops that were located there were disbanded. In 1917, 639 steamers and 2,563 junks entered and cleared at Weihaiwei. The imports are mainly petroleum, flour, cotton goods, sugar, foodstuffs and coal; the exports are ground nuts and ground-nut seeds (290,687 hundred-weight in 1917), and salt fish. There is a mail service to Shanghai and Europeans seek the locality in summer to escape the heat of the region farther south. Consult Annual Report on Weihaiwei; Bruce-Mitford, C. E., 'The Territory of Weihaiwei' (Shanghai 1902); Johnston, R. F., 'Lion and Dragon in Northern China' (London 1910).

WEIMAR, vī'mär, Germany, the capital of the grand duchy of Saxe-Weimar, on the Ilm, 13 miles east of Erfurt. It stands in a beautiful valley surrounded by hills, on ground partly elevated and partly flat. It is irregularly built except in the suburban portions. Its notable public edifices are the grand-ducal palace, a handsome structure erected partly under the superintendence of Goethe; the so-called Red and Yellow castles, now united and occupied by several public departments; the grand-ducal library (in the Green Castle), containing 300,000 volumes and a large collection of maps; the museum; the Stadtkirche, with an altar-piece, one of the finest works of Lucas Cranach, in which he has introduced portraits of himself and Luther and Melanchthon; and the modern Gothic town-house. The public monuments comprise the Goethe-Schiller monument in bronze, statues of Herder, Wieland, the composer Hummel, the Grand-Duke Karl August and various others, and a monumental fountain. Goethe's house is now used as a Goethe National Museum, and Schiller's contains relics of its former distinguished owner. A Goethe and Schiller Archives building was opened in 1896. Goethe and Schiller are interred in the grand-ducal vault in the new cemetery. Stretching away from the palace is a fine park on the banks of the Ilm. Weimar has a gymnasium, a realgymnasium, academy of painting, school of drawing, normal school and other educational institutions. It has neither trade nor manufactures of much consequence, the manufactures of iron, wood, straw, leather and cloth being carried on to some extent, but as the capital of the duchy it is the seat of the legislature and of all the more important courts and public offices. It long ranked as a sort of "German Athens" in consequence of the enlightened patronage which the Duke Karl August (d. 1828) afforded to the four great literary men of Germany, Goethe, Schiller, Herder and Weiland. In 1919 the National Assembly of the German nation met at Weimar and there the constitution of the new German Republic was made and adopted. The Treaty of Versailles (1919) was ratified at Weimar during the session of the assembly. Pop. 33,000.

WEINGARTNER, vīn'gärt-nĕr, **Felix**, Austrian composer: b. Zara, Dalmatia, 2 June 1863. He studied at the Leipzig Conservatory, having received a government scholarship, and in 1884 his opera, 'Sakuntala,' was brought out at Weimar under the patronage of Liszt. He was musical conductor at Königsberg, Dantzig and Hamburg in 1884–89 and in 1891 was appointed court conductor at Berlin. Ill health compelled the resignation of this post, and in 1898 he settled in Munich as conductor of the Kaim concerts. He has composed numerous songs, several symphonic poems, the operas 'Malawika' (1886); 'Genesius' (1892); 'Kain und Abel' (1914); 'Dome Kobold' (1916), etc. He has written 'Die Lehre von der Wiedergeburt und das Musikalische' (1895); 'Beyreuth 1876 bis 1896' (1897). Consult 'Luies' by Lusztig and by Raabe, both published in Berlin in 1908.

WEINMAN, Adolph Alexander, American sculptor: b. Carlsruhe, Germany, 11 Dec. 1870. He came to the United States when a child and later studied art in New York, under Saint Gaudens at the Art Student's League, and at Cooper Union. He is a member of the National Academy, the National Sculpture Society and the National Institute of Arts and Letters. In 1915 he served on the International Jury of Awards at the Panama Exposition. Among his works are the General Macomb monument, Detroit, Mich., the Lincoln memorials at Hodgenville, Ky., and at Madison, Wis., the Lincoln statue at the State Capitol, Frankfort, Ky., the statuette of Lincoln at the Metropolitan Museum of Art, New York, and the Indian head at the Brooklyn Institute Museum.

WEIR, wēr, **Harrison William**, English artist and journalist: b. Lewes, Sussex, 5 May 1824; d. London, 4 Jan. 1906. He learned the art of wood-engraving, but disliking it turned to painting, and his first exhibition at the British Institution was in 1843. He was the last survivor of the original staff of the London *News* and was engaged on the *Graphic*, *Pictorial Times*, *Black* and *White* and other London periodicals. He was an authority on the correct delineation of domesticated animals, was noted for his paintings of country life and as an illustrator of books and periodicals. He wrote and illustrated 'The Poetry of Nature'; 'Every-day Life in the Country'; 'Our Cats and All About Them', etc. Perhaps his greatest achievement was his work 'Our Poultry and All About Them' (1903), the writing and illustrating of which claimed his attention for more than 20 years.

WEIR, James, American physician and author: b. Owensboro, Ky., 17 Oct. 1856; d. there, 9 Aug. 1906. He was graduated from the University of Louisville in 1878 and studied medicine there and in New York. He published 'Religion and Lust' (1897); 'The Dawn of Reason' (1898); 'Intelligence in the Lower Animals' (1898).

WEIR, John Ferguson, American painter, sculptor and author, son of R. W. Weir (q.v.): b. West Point, N. Y., 28 Aug. 1841. He was a pupil of his father and became a member of the National Academy in 1866. Since 1869 he has been professor of painting in the Yale School of Fine Arts. As a sculptor he is known by his statues of President Woolsey and Professor Silliman of Yale, and in addition to many portraits he has painted 'The Gun Foundry'; 'The Forging of the Shaft'; 'The Column of Saint Mark's, Venice,' etc. He has written 'John Trumbull and His Works' (1902); 'Human Destiny in the Light of Revelation' (1903).

WEIR, Julian Alden, American artist, son of R. W. Weir (q.v.): b. West Point, N. Y., 30 Aug. 1852; d. New York, 8 Dec. 1919. He studied with his father and at Paris with Gérôme, became a member of the Society of American Artists in 1877 and a National Academician in 1886. Mr. Weir was one of the founders of the Society of American Artists, the first organization to rebel at all effectively against the Academy. These societies were later united and Mr. Weir at once refused the presidency of the Association of American Painters and Sculptors because it was in opposition to the Academy. He painted many kinds of pictures, subjects, still life, portraits, figures, landscapes. In his later career he was identified with the Impressionist School. Examples are to be found in the Luxembourg, Paris, and in nearly every important art museum in the United States, including the National Gallery, Washington, the Art Institute of Chicago, the Albright Gallery, Buffalo, the Pennsylvania Academy, Philadelphia, and the Brooklyn Institute. 'Breton Interior' obtained a second-class medal at the Paris Exposition of 1889. His 'Idle Hours,' now in the New York Metropolitan Museum, received the $2,000 prize of the American Art Association. In the same gallery are 'The Red Bridge' and 'The Green Bodice,' the latter one of Weir's masterpieces. Weir's long career as an artist was marked by independence and naturalness. It was only after repeated experiments that he achieved the general recognition which the reticent, refined, and distinguished style of his maturity deserved.

WEIR, Robert Walter, American artist: b. New Rochelle, N. Y., 18 June 1803; d. New York, 1 May 1889. After studying under Jarvis he began portrait painting in 1821 and then studied in Florence under Benvenuti, 1821–28. In 1829 he became a National Academician and was professor of drawing at West Point 1837–79. He was of especial prominence as a historical painter and among his works are the 'Embarkation of the Pilgrims' (1845) in the rotunda of the Capitol at Washington; the 'Church of the Holy Innocents' (1847), Corcoran Art Gallery, Washington; and 'Peace and War,' painted for the chapel at West Point.

WEIR, a dam. See HYDRAULICS; IRRIGATION; WATER SUPPLY.

WEIRS, Fishing. See POUND-NET FISHING.

WEISER, Idaho, city and county-seat of Washington County, on Snake River, 60 miles northwest of Boise and on the Pacific and Idaho Northern and the Oregon Shortline railroads. The Intermountain Institute is located here. There are flour mills. The surrounding district is interested in stock-raising and mining. Pop. 2,600.

WEISHAUPT, vis'howpt, **Adam,** German mystic: b. Ingolstadt, 6 Feb. 1748; d. Gotha, 18 Nov. 1830. He was the founder of the Society of the Illuminati (q.v.). Educated at Ingolstadt, he there became in 1772 extraordinary professor of law and in 1775 professor of natural and canon law. His appointment to the latter post brought him into collision with the clergy, especially the Jesuits, as after the suppression of their order he became their bitter enemy, although he had been educated by them. He formed the plan of uniting a large number of men together to sustain certain perfectionist views and his instruction-room soon became a nursery of his doctrines. In 1785 he was obliged to leave Ingolstadt and retired to Gotha, where he was afterward made councillor of state by the duke. His most important writings are 'Geschichte der Verfolgung der Illuminaten' (1786); 'Das verbesserte System der Illuminaten' (1787); 'Pythagoras, oder Betrachtung über die geheime Welt- und Regierungskunst' (1790); 'Materialien zur Beförderung der Welt- und Menschenkunde' (1850); 'Ueber Staatsausgaben' (1820); and 'Ueber das Besteuerungssystem' (1820).

WEISMANN, vis'mān, **August,** German biologist: b. Frankfurt-on-the-Main, 17 Jan. 1834; d. 6 Nov. 1914. After studying medicine in Göttingen University he was clinical assistant at Rostock in 1856–57 and in the course of the three years 1858–60 visited Vienna, Italy and Paris, devoting himself especially to studies in the natural sciences. He lived for a year at Schaumburg Castle as body physician to the Archduke Stephen of Austria and in 1863 went to Giessen to prosecute his zoological studies under Leuckart. Having qualified as a lecturer in the University of Freiburg, he was appointed extraordinary professor there in 1866 and ordinary professor in 1873. His first published work was a treatise on the 'Development of the Diptera' (1864). It was followed by a work 'On the Influence of Isolation on the Formation of Species' (1872) and 'Studien zur Descendenztheorie' (1875–76). This work, translated into English in 1882 by Professor Meldola under the title 'Studies in the Theory of Descent' (with a preface by Charles Darwin), treats of several important phenomena in natural history from the standpoint of a thorough believer in the doctrine of natural selection. His 'Beiträge zur Naturgeschichte der Daphnoiden' (1876–79) and 'Die Entstehung der Sexualzellen bei den Hydromedusen' (1883) are valuable contributions to the developmental aspect of zoology. A series of treatises followed in which he developed his characteristic theories, among them being 'Ueber die Vererbung' ('On Heredity'),

'Uber die Dauer des Lebens' ('On the Duration of Life'), 'Ueber Leben und Tod' ('On Life and Death'), 'Die Kontinuität des Keimplasmas als Grundlage einer Theorie der Verebung' ('The Continuity of the Germ-Plasm as the Basis of a Theory of Heredity'), 'Die Bedeutung der Sexuellen Fortpflanzung für die Selektionstheorie' ('The Significance of Sexual Reproduction for the Theory of Selection'), 'Ueber den Rückschritt in der Natur' ('On Retrograde Development in Nature') and 'Amphimixis.' These have appeared in an English translation under the title 'Essays upon Heredity and Kindred Biological Problems' (Vol. I, 1889; Vol. II, 1892). Weismann's other works include 'Das Keimplasma' (1892), in English as 'Germ Plasm' (1893); 'Die Allmacht der Naturzüchtung' ('The Omnipotence of Natural Selection,' 1893); 'Aeussere Einflüsse als Entwickelungsreize' ('External Influences as Stimuli to Development,' 1894); 'Neue Gedanken zur Vererbungsfrage' ('Fresh Thoughts on the Question of Heredity,' 1895); and 'Ueber Germinalselektion' ('On Germinal Selection,' 1896). See HEREDITY; WEISMANNISM.

WEISMANNISM, the essential teaching of August Weismann (q.v.), sometimes referred to as "Neo-Darwinism." Interest and controversy have gathered mainly round his answer to the question, "How is it that a single cell of the body can contain within itself all the hereditary tendencies of the whole organism?" In all theories of heredity (q.v.) biologists have assumed that characters acquired by the individual are transmitted to offspring. This Weismann denies and while biologists have concerned themselves with speculation as to the mode by which such transmissions are effected, he challenges them to prove that they are effected at all. The burden of proof is thus thrown upon his opponents, whose assumptions must give way to experimental evidence, which alone can determine, and that only after protracted record of cases, whether individually acquired characters are transmitted or not. Death, he contends, is not a primary attribute of living matter; the protozoans, or one-celled organisms, being immortal in so far that they do not die naturally. The protozoan, a microscopic jelly-like, apparently — not really — structureless mass, with no seeming unlikeness of parts, multiplies by division. Each half becomes a complete individual and grows in like manner as the whole to which it belonged, till it also divides and so on with the multiplication of protozoans *ad infinitum*. It cannot be said of either half that one is parent and the other offspring, for both are of the same age, and only, in a limited sense, as the subdivisions into separate individuals are repeated, can we speak of succession of generations. In these processes there is nothing analogous to death. "There are," Weismann says, "no grounds for the assumption that the two halves of an amœba are differently constituted internally, so that, after a time, one of them will die while the other continues to live. Observations show that when division is almost complete the protoplasm of both parts begins to circulate and for some time passes backward and forward between the two halves. A complete mingling of the whole substance of the animal and a resulting identity in the constitution of each half is thus brought about before the final separation? Consequently, there is unlimited persistence of the individual; potential, although not absolute, immortality so long as life lasts on the earth.

While the one-celled organisms are thus immortal, only the reproductive cells of the metazoans, the many-celled, are immortal. How has this come about? Weismann accounts for it by the failure of certain protozoans to divide equally, whereby unlikeness of parts and differences of position of parts resulted. "The first multicellular organisms were probably clusters of similar cells, but these units soon lost the original homogeneity. As the result of mere relative position there arose division of labor, some of the cells were especially fitted to provide for the nutrition of the colony, while others undertook the work of reproduction." Clearly, those on the outside, being exposed to the direct and constant action of their surroundings, would be the media of nutrition, and the builders-up of the cell-commonwealth. So the result of this cell-clustering would be that the cells fell into two classes, body cells and germ-cells. While the body cells were solely concerned with the nutrition of the organism, losing in this specialization of function the power of reproduction, that power became concentrated in the germ-cells, or, speaking more precisely, in the germ-plasm, which is located in the nucleus of the germ-cell. It is these germ-cells which are the immortal part of the metazoans. With increasing subdivision of function there has been increasing modification of the organism, but the two-fold classification of the somatic or body cells and the germ-cells has remained. The death of the body cells is involved in the ultimate failure to repair waste, because a worn-out tissue cannot forever renew itself, and because cell-division has its limits. In brief, death is the penalty paid for complexity of structure. As it is impossible for the germ-cell to be, as it were, an extract of the whole body, and for all the cells of the body to dispatch particles to the germ-cells whence these derive their power of heredity (the fundamental idea of Darwin's theory of pangenesis, q.v.), the germ-cells, so far as their essential and characteristic substance is concerned, are not derived from the body of the individual, but directly from the parent germ-cell. Heredity, Weismann contends, is secured by the transference from one generation to another of a substance with a definite chemical and molecular constitution — in other words, by the "continuity of the germ-plasm." This germ-plasm (which, Weismann's critics argue, runs perilously near a metaphysical concept) is assumed to possess a highly complex but extremely stable structure, so stable "that it absorbs nourishment and grows enormously without the least change in its complex molecular structure." Of this germ-plasm it is further assumed that a small portion contained in the parent egg-cell is not used up in the construction of the body of the offspring, but is reserved unchanged for the formation of the germ-cells of the following generations. Only variations of the germ-plasm itself are inherited, and it is upon these variations that natural selection operates. Variations are due not to

the influence of external condition nor to use or disuse of organs, but to sexual conjugation. The process combines two groups of hereditary tendencies derived from the mingled germ-plasms of the male and female parents, resulting in those individual differences which form the material from which new species are produced by the action of natural selection. Those differences multiply in geometrical ratio.

The sum of the matter is that natural selection (q.v.) is the dominant factor, that use and disuse of parts and the action of the environment count for nothing, or, at the most, for but a little. (See USE AND DISUSE). Here and there Weismann makes concessions as to the modifying influences of body cells on the germ-cells, and as to the ultimate origin of hereditary individual differences in the direct action of surroundings, which are a partial surrender of his main contention as to the isolation of the germ-plasm. It is not easy to reconcile the theory of an insulated germ-plasm with the ceaseless manufacture, secretion and expulsion of germ-cells, the materials of which are derived from the materials nourishing the entire organism; nor with the subtle influence of the nervous system on the reproductive organs.

Perhaps the most serious difficulty in Weismann's theory is in the reconciliation of psychological evolution with the continuity of the germ-plasm. For the researches of Spencer, Balfour and others have demonstrated that the nervous system had its origin in modifications of the primitive skin due to the direct action of the environment. Be this as it may, the wide-reaching sociological significance of the doctrine of heredity — which may be regarded as the physical correlate of determinism — gives an importance to the labors of Weismann that cannot be overrated, and makes urgent the record of extended observations on the lines already laid down by Galton.

Bibliography.— Haeckel, 'Generelle Morphologie' (1866); Darwin, 'Variation Under Domestication' (1868); Brooks, 'The Law of Heredity' (1883); Virchow, 'Descendenz und Pathologie' (Virchow's Archiv, ciii, 1886); Eimer, 'Die Entstehung der Arten' (1888); Galton, 'Natural Inheritance' (1889); Romanes, 'An Examination of Weismannism' (1893); Spencer, 'A Rejoinder to Professor Weismann' (1894); Hertwig, 'The Biological Problem of To-day' (1894). For critiques of Weismann, consult Eimer, Virchow, *op. cit.*; Spencer, 'Factors of Organic Evolution' (1886); McKendrick, 'General Physiology' (1888) and the files of *Nature*.

WEISS, Charles Andre, French authority on international law: b. Mulhouse, Alsace, 30 Sept 1858. He took his LL.D. at the University of Paris in 1880 and later became a member of the faculty there. He has been prominently connected with various societies and commissions dealing with international law, and has written voluminously and with praiseworthy clarity upon the subject. He is a chevalier of the Legion of Honor. Author of 'Traité élémentaire de droit international privé' (1882); 'Traité théorique et practique de droit international privé' (1892); 'Le droit civil et la législation comparée' (1900); 'Manual de droit international privé' (1905); 'The Violation by Germany of the Neutrality of Belgium and Luxemburg' (1915); 'La Reparation des dommages de guerre' (1917), etc.

WEISS, John, American clergyman: b. Boston, 28 June 1818; d. there, 9 March 1879. He was graduated at Harvard in 1837; in the winter of 1842–43 studied at Heidelberg, Germany; was graduated in the last-named year at the Harvard Divinity School, and settled as minister of a Unitarian church in Watertown, Mass. His anti-slavery utterances having disturbed the harmony of his pastorate, he resigned, and in 1847 became minister of a Unitarian society in New Bedford, Mass., but was soon compelled by reason of ill health to retire. Again in 1859–70 he was minister of the Watertown church, from which he finally withdrew in order to pursue his literary work. He was one of the most brilliant of the New England reformers and transcendentalists, and his writings display a mind at once mystical and scientific, strongly rationalistic on religious subjects, but endowed with a fine poetic power of interpretation, which he applied to religious history and symbolism, as well as to questions of philosophy and life, to which he brought prophetic insight and fervor. His publications include 'Æsthetic Prose' (1845), a translation of Schiller's philosophical and æsthetic essays; 'Life and Correspondence of Theodore Parker' (1864); 'American Religion' (1871); 'Wit, Humor, and Shakespeare' (1880); and 'The Immortal Life' (1880).

WEISSENFELS, vīs'sĕn-fĕls, Germany, town in the Prussian province of Saxony, on the Saale River, 14 miles southwest of Leipzig, on the main line of the railroad from Bebra to Frankfort-on-the-Main. It was the capital of the duchy of Saxe-Weissenfels in 1656–1746. The Augustusburg Palace, built in 1664–90, is now used as a military school. There are deposits of lignite and sandstone in the vicinity. Manufactures include machinery, ironware, shoes, paper, sugar and electrical appliances. Pop. 33,581.

WEITENKAMPF, Frank, American connoisseur of prints: b. New York, 13 April 1866. He studied at the Art Students' League, New York. He is chief of the art and print departments of the New York Public Library, where he has done notable work in arranging continuous exhibitions of carefully selected prints; and he has also done considerable art propaganda work in disseminating information concerning prints through the press. In 1914 New York University gave him the degree L.H.D. He has prepared many pamphlets cataloging and describing prints; has contributed to various encyclopedias and to the 'Standard Dictionary'; and is author of 'How to Appreciate Prints' (1908; new ed., 1916); 'American Graphic Art' (1912).

WEITLING, Wilhelm Christian, German communist: b. Madgeburg, Prussia, 1808; d. New York, 25 Jan. 1871. He early became an advocate of communism, traveling and lecturing in its behalf. He took part in the Revolution of 1848 and afterward came to the United States. He founded the Socialist society known as Arbeiterbund in New York, and was connected with the establishment of a communistic colony in Wisconsin, although he lived in New York. Author of 'Guaranties of Harmony and

Freedom' (1842); 'Humanity as It Is and as It Should Be' (1845), etc.

WEITSPEKAN (wīt'spĕk-ạn) **INDIANS** (from *W'eitspek*, the name of one of their towns). A linguistic stock of North American Indians, comprising several small tribes collectively known as the Yurok, occupying the lower Klamath River in California from the mouth of the Trinity down. On the coast Weitspekan territory extends from Gold Bluff to about six miles above the mouth of the Klamath. The Chilula are an offshoot of the Weitspek, living to the south of them, on Redwood Creek to a point about 20 miles inland, and from Gold Bluff to about midway between Little and Mad rivers.

WELBECK ABBEY, England, the seat of the Duke of Portland, in Nottinghamshire, three miles south of Worksop. It occupies the site of an old Premonstratensian abbey and came into the possession of the Portland family by marriage in 1734. It stands in a park 10 miles in circumference and is a stately Palladian edifice of mainly the 17th and 18th centuries, but was greatly enlarged about 1864 by the fifth duke, to whom it owes its semi-underground picture gallery, ballroom and riding-school, the last 385 feet long, 104 feet wide and 51 feet high.

WELCH, Ashbel, American civil engineer: b. Nelson, N. Y., 4 Dec. 1809; d. Lambertville, N. J., 25 Sept. 1882. He was engaged as an engineer on the Lehigh Canal in 1827; was made chief engineer of the Delaware and Raritan Canal in 1835 and afterward planned the route and constructed the Belvidere and Delaware Railroad. In 1862 he became manager of the Pennsylvania Railroad lines in New Jersey and subsequently was made president. He introduced the block system (q.v.) in railroading in the United States and published papers on economics and civil engineering. He was elected president of the American Society of Civil Engineers in 1881.

WELCH, Herbert, American clergyman and educator: b. New York City, 7 Nov. 1862. He was graduated at Wesleyan University 1887 (A.M., 1889; D.D., 1902; LL.D., 1906; B.D., from Drew Theological Seminary 1890). Studied at Oxford University, 1902–03. He entered the ministry of the Methodist Episcopal Church, joining the New York East Conference in 1890. After several pastorates in important churches in and around New York and Brooklyn he was elected president of Ohio Wesleyan University, Delaware, Ohio, in 1905. In 1916 he was elected bishop and assigned to Korea. He was president of the Ohio Association of College Presidents and Deans, 1907–08; president of the Methodist Federation for Social Service, 1907–12 and since then vice-president. He has also been a member of the boards of managers of several of the denominational societies of his Church. In 1914 he was fraternal delegate to the Methodist Church of Canada. He edited 'Selections from the Writings of John Wesley' (1901).

WELCH, Philip Henry, American humorist: b. Angelica, N. Y., 1 March 1849; d. Brooklyn, N. Y., 24 Feb. 1889. From 1882 to 1884 he was attached to the staff of the Rochester *Post-Express*, and then removing to New York was employed by the *Sun*. He was prominent among the humorous press writers of his time and was an able satirist. He published 'The Tailor-Made Girl' (1888); and 'Said in Fun' (1889).

WELCH, William Henry, American pathologist: b. Norfolk, Conn., 8 April 1850. He was graduated from Yale in 1870 and from the College of Physicians and Surgeons in New York in 1875. He studied pathology abroad, becoming in 1878 demonstrator of anatomy at the Bellevue Hospital Medical College, New York. Since 1884 he has been a professor of pathology at Johns Hopkins University. He is an eminent authority on bacteriology and pathology and is the author of 'General Pathology of Fever,' 'Thrombosis and Embolism' and numerous professional papers. He was Huxley lecturer at Charing Cross Hospital, London, in 1902, and served as president of the Congress of American Physicians and Surgeons in 1897.

WELCH, W. Va., town and county-seat of MacDowell County, situated on the Big Sandy River and on the Norfolk and Western Railroad, 71 miles east southeast of Williamson. It has the county buildings, post office, town hall, several churches, school, etc. Agriculture is the basic industry of the surrounding region for which the town serves as a shipping and distribution point. Pop. about 600.

WELCKER, vĕl'kĕr, **Friedrich Gottlieb,** German archæologist: b. Grünberg, Hesse, 4 Nov. 1784; d. Bonn, Rhenish Prussia, 17 Dec. 1868. He was educated at Giessen, and in 1806–09 was a tutor in the family of Wilhelm von Humbolt at Rome. In the last-named year he accepted the chair of archæology at Giessen and in 1816 became professor at Göttingen, a position he resigned in 1819 to accept the chair of archæology at Bonn. Political troubles in 1832 caused his dismissal, but he was shortly afterward recalled and occupied the post until 1861 when he retired. As a classical scholar Welcker held high rank; his extensive writings on Greek art, history and mythology are of great and lasting value. 'Die griechische Tragödie mit Rücksicht auf den epischen Cyclus geordnet' (3 vols., 1841) is perhaps his greatest work. He prepared editions of Alcman, Hipponax, Philostratus' 'Imagines,' Theognis, Hesiod's 'Theogony' and 'Kleine Schriften' (6 vols.). Among the most notable of his other works are 'Aeschyleische Triologie' (1824); 'Der epische Cyclus' (1835–49); 'Alte Denkmäler (1849–64); 'Griechische Götterlehre' (1863), etc. Consult Kekulé, 'Das Leben Friedrich Gottlieb Welckers' (1880).

WELD, Theodore Dwight, American philanthropist and educator: b. Hampton, Conn., 23 Nov. 1803; d. Hyde Park, Mass., 3 Feb. 1895. He was the son of Ludovicus and Eliza (Clark) Weld, and of lineal descent from Jonathan Edwards. He entered Phillips-Andover Academy, but left school because of impaired sight. He was one of the 63 original founders of the American Anti-Slavery Society, and in 1833 was secretary of that society; and in 1830 he was agent of the Society to Promote Manual Labor in Schools. He entered Lane Theological Seminary, Cincinnati, Ohio, and taught colored youths evenings. He was conspicuous for unselfish charities and fair dealings, and did not

hesitate to denounce slavery and the slave trade openly and publicly. He left the seminary when the trustees suppressed the local anti-slavery organization and began a course of lectures. He was repeatedly mobbed, but his commanding presence and athletic attainments, as well as his fearless and wonderful eloquence, enforced respect; at Granville, Ohio, when advised that the church would be burned if he lectured as advertised, he informed the trustees that he would then speak from its foundations; to threatening letters he replied: "Come, but bring your own winding sheets, which I cannot supply"; six undisturbed lectures followed. At Painesville, Ohio, such was his eloquence that the leader of the mob kicked in the head of the bass drum with which he had thought to drown the speaker's voice. In 1836 his voice partially failed him, but he taught school and used his pen vigorously. In 1838 he married Angelina Emiline, daughter of Judge John Grimke, of South Carolina, who, having become a Quaker in 1835, emancipated her inherited slaves. He edited the American Anti-Slavery Society's publications in Washington, D. C., and was confidential adviser with Congressmen who favored abolition of slavery in the District. In 1854 he established a school at Englewood, N. J., for the joint education of white and black youth; in 1864 removed to Hyde Park, Mass., and aided in founding the historical society, the public library and the school system.

WELDING is the intimate union produced between the surfaces of two pieces of metal, when heated to the point of fusion and hammered or pressed together. To weld a bar of iron to another piece of iron requires an intense white heat and the use of a flux or welding compound. Steel can be welded at a slightly lower temperature than iron. The essential condition to a good weld is that the plastic state of the metal shall be maintained for a short time without its melting away or burning. Borax, ammonium chloride, potassium carbonate and various alkalis are used as fluxes. (See ELECTRIC WELDING). Some solids can be welded by pressure, as graphite, coal, asbestos, etc. Horn may be welded between hot metal plates by pressure, by using hot water or wet cloth to protect the horn surfaces. Consult Kantny, T., 'Autogenous Welding and Cutting' (New York 1915).

WELDING, Electric. See ELECTRIC WELDING.

WELDING, Gas (Oxy-Acetylene). Development of Oxy-Acetylene Processes.—Gas welding consists of melting the edges of two pieces of metal so that they run together and become solid when cold. A good weld requires a very intense flame, such as is obtained from acetylene and oxygen. By the oxy-acetylene process two sections of like metal can be so united that the two members form a homogeneous whole, so perfect that the weld cannot be distinguished when machined. Examination reveals the same uniformity of metallic texture throughout the weld. In this important respect oxy-acetylene welds are recognized as the highest examples of the science of welding. Oxy-acetylene welding, now generally spoken of as oxwelding, has attained a very important and practically indispensable place in the iron and steel industry. It is used in practically all forms of construction and manufacture, and is applied to almost countless operations in production and repairs. It is extensively used in low and high pressure pipe-lines and for butt-welding of metal tubing. Ninety per cent of the railroads in the United States use this process in their shops and on the road, and approximately 35,000 locomotives now in service have welded joints that withstand standard steam pressure. The extent to which oxy-acetylene welding was used during the World War of 1914–18 in the manufacture of depth bombs, torpedo casings, poison gas tanks and other supplies and munitions in which speed and volume of production were vital is well known. Practically all of the enormous number of high explosive and other large shells manufactured in America during the war were made from steel billets cut to size by the oxy-acetylene process. In the field, army trucks and repair shops were universally equipped with oxy-acetylene welding and cutting outfits, and in France numerous depots were established where broken and damaged metal parts were quickly repaired by oxy-acetylene and put back into service. In peace times the oxy-acetylene cutting torch is extensively used in the wrecking of steel structures, in cutting of scrap to sizes for the cupola, in the cutting of armor plate of any thickness, and in fact wherever steel and wrought iron are to be cut, from the largest shipyard down to the smallest industrial plant.

The equipment required for oxy-acetylene welding consists of a cylinder or tank of oxygen, a tank of acetylene, two regulators or reducing valves (one each for the acetylene and oxygen tanks), a welding blowpipe and two pieces of hose to connect the blowpipe to the regulators. The cutting equipment is very similar excepting as to the type of the blowpipe used and special hose to sustain the higher oxygen pressure used in cutting. Of the gases adapted to blowpipe use, acetylene and oxygen are by far the most extensively applied, owing to their special fitness industrially, both being obtainable in portable cylinders at low cost. Acetylene contains 1,475 B.T.U.'s, and this very high heat content, together with its endothermic characteristics, conduces to speed in accomplishing a given quantity of work as well as being a material factor in the excellence of the work. Acetylene was discovered by Edmund Davy, an English chemist, in 1836; but it remained a laboratory gas until the development, more than half a century later, of a practical method for producing calcium carbide in commercial quantities. Thomas L. Willson, the American electro-metallurgist, in 1891-92 conducted a series of experiments with a mixture of lime and coal tar heated to high temperature in a Heroult electric furnace, resulting in what may be termed the "commercial discovery" of calcium carbide and leading to the establishment, in 1895, of the first factory in the world for the manufacture of carbide.

In the early years of its commercial application, acetylene generated from carbide was used chiefly as an illuminating gas, and so great was the demand for acetylene for house and town lighting that the industry soon became one of considerable importance. By 1901 calcium carbide was being produced in large quantities and distributing warehouses were established

throughout the country. This was shortly followed by development of Prest-O-Lite portable acetylene cylinders containing acetylene dissolved in acetone. The convenience of portable acetylene, rendering the gas available everywhere, created a tremendous demand for acetylene in this form and resulted in the Prest-O-Lite company's becoming an enterprise of large magnitude, with plants in various States and distributing and service depots in every important centre in the country.

Up to 1905 the development of economical processes for obtaining oxygen had been almost entirely neglected; so, while the application of acetylene and oxygen to metal welding and cutting dates experimentally from 1901 and industrially from 1903, the development of the processes was seriously retarded owing to the cost of oxygen and the difficulty of obtaining an adequate supply. In the early years of the industry the users of the process were largely dependent on their own limited facilities for the production of oxygen from chemicals. Consequently the oxy-acetylene industry was given a tremendous impulse when, in 1907, a liquid air oxygen plant was put into operation in this country. It is a well-known fact that oxygen produced by the liquid air process is of the highest purity. This was the first unit of what has since become the great system of oxygen plants developed by the Linde Air Products Company, who now maintain producing plants and warehouses in more than 50 of the large industrial centres. From that time on the production of both oxygen and acetylene increased amazingly, keeping pace with the rapidly expanding applications of oxy-acetylene welding and cutting. The now almost universal adoption of the processes is due to their speed and economy combined with the characteristic excellence of oxwelding and cutting that is attained by the competent operator using standard equipment. See LIQUEFIED AND COMPRESSED GASES — ACETYLENE.

WELDON, Richard Chapman, Canadian legislator and educator: b. Sussex, New Brunswick, 19 Jan. 1849. He was graduated at Mount Allison University in 1866; took his Ph.D., at Yale University in 1872; later studied at the University of Heidelberg; and in 1884 was called to the bar of New Brunswick. He was professor of mathematics at Mount Allison University in 1875–83; and held the chair of constitutional law and was dean of the law faculty at Dalhousie University in 1883–1914. He served in the Dominion Parliament in 1887–96.

WELDON, N. C., a town in Halifax County, on the Roanoke River and the Seaboard Air Line and Atlantic Coast Line railways, 97 miles east of Raleigh. It is at the head of steamboat navigation on the Roanoke. Here are located six churches, a State bank, a winery, several mills and a weekly newspaper. There is excellent water power and cotton mills, a corn mill, knitting mill, oil mill and machine shops have been established. The surrounding region is an agricultural one. Pop. 2,600.

WELFARE WORK IN INDUSTRIES. See INDUSTRIES, WELFARE WORK IN.

WELL-TEMPERED CLAVIER (from Ger. *Wohltemperirte Klavier*), the celebrated collection of 48 preludes and fugues composed by J. Sebastian Bach, 1685–1750 (q.v.) to test the system of equal temperament in tuning. For this purpose he wrote a prelude and fugue in each key, the keys following one another not in relation, but in the order of chromatic ascent. (See MEANTONE; MODE; TEMPERAMENT). Consult Grove, 'Dictionary of Music and Musicians' (Vol. V, pp. 553–555, New York 1911).

WELLAND, Canada (formerly MERRITTSVILLE), town and county-seat of Welland County, Ontario, on Welland River and the Welland Canal, 20 miles northwest of Buffalo, N. Y., and on the Michigan Central, the Grand Trunk, the Canadian Pacific and the Pere Marquette railroads. There are two government docks, a turning basin and manufactures of woolens and fencing material. There is also a peat industry. Pop. 5,318.

WELLAND CANAL, Ontario, Canada, a ship canal extending from Port Colborne to Port Dalhousie, across the neck of land west of the Niagara River and Falls, and maintaining continuous navigation between Lake Erie and Lake Ontario. See CANADIAN CANALS.

WELLDON, James Edward Cowell, English prelate and educator: b. Tonbridge, Kent, 25 April 1854. He was educated at Cambridge, was head master of Dulwich College 1883, and of Harrow School, 1885–98. In the last-named year he was appointed to the bishopric of Calcutta, and as such was metropolitan of India. He resigned in 1902 and returned to England, where he was made canon of Westminster. Besides standard translations of Aristotle's 'Politics,' 'Rhetoric' and 'Nicomachean Ethics,' he has published 'Sermons Preached to Harrow Boys' (1887); 'The Spiritual Life and Other Sermons' (1888); 'The Hope of Immortality' (1898); 'The Revelation of the Holy Spirit' (1902); 'The Gospel in a Great City' (1910); 'The Religious Aspects of Disestablishment and Disendowment' (1911); 'Recollections and Reflections' (1915).

WELLE-MAKWA, wĕl'lĕ-māk'wā, central Africa, the most important affluent of the Ubangi (q.v.), a tributary of the Kongo. Its source is on the western slope of Mount Emin Pasha, and after a course of about 800 miles through a fertile and rich country to the north and east of the Kongo, it flows into the Ubangi at Dayu, opposite Yakoma, at the confluence of two other headstreams. The identity of the Welle-Makwa was uncertain for many years; explorers thought it was a different stream to the Ubangi, but their connection was fully established in 1888, and the river throughout its entire length of 1,500 miles is sometimes called the Welle-Makwa.

WELLER, Reginald Heber, American Protestant Episcopal bishop: b. Jefferson City, Mo., 6 Nov. 1857. He studied at the University of the South 1875–77, and was graduated from the Nashotah Theological Seminary, Wisconsin, in 1884. Ordained to the priesthood in the last-named year he was rector of Eau Claire, Wis., 1884–88; of Waukesha, Wis., 1888–90 and of Stevens Point, Wis., 1890–1900. He was consecrated bishop-coadjutor of Fond du Lac 8 Nov. 1900, the somewhat spectacular ceremonial practised on this occa-

tion calling forth more or less criticism; and succeeded as bishop 30 Aug. 1912.

WELLES, wĕlz, **Gideon,** American statesman, b. Glastonbury, Conn., 1 July 1802, d. Hartford, Conn., 11 Feb. 1878. He studied at Norwich University, Vermont, but did not complete the course there, and for a time turned his attention to the study of law. In 1826, however, he entered journalism as editor of the Hartford *Times*, which under his management became one of the leading Democratic papers of the State. He was one of the first publicly to advocate Andrew Jackson's election to the Presidency, and always warmly supported him. In 1827–35 he was a member of the Connecticut legislature, and both as legislator and editor advocated the abolition of imprisonment for debt, opposed the practice of special legislation and succeeded in obtaining the passage of general laws for the incorporation of business corporations. In 1836 he resigned the editorship of the *Times*, but continued to write for that paper. In 1835, 1842 and 1843 he was chosen State comptroller; in 1836–41 he was postmaster of Hartford; and in 1846 was appointed chief of the bureau of provisions and clothing in the Navy Department, which office he held till 1849. He had always been opposed to the extension of slave territory, and on the organization of the Republican party in 1855 became identified with it, and was Republican candidate for governor of Connecticut in 1856; and a member of the national committee. In 1861 he was appointed Secretary of the Navy, and conducted the affairs of his department with marked executive ability throughout the Civil War; he continued in office under President Johnson till 1869. He was later affiliated with the Liberal Republicans, and in 1876 was a supporter of Tilden. He wrote 'Lincoln and Seward' (1874). Consult 'Diary of Gideon Welles' (New York 1911).

WELLESLEY, wĕlz'lĭ, **Arthur.** See Wellington, Arthur Wellesley, Duke of.

WELLESLEY, Richard Colley, Viscount and Marquis, British statesman: b. Dublin, 20 June 1760; d. London, 26 Sept. 1842. He was educated at Oxford, and on his majority took his seat as Earl of Mornington in the Irish House of Peers. Three years after he was returned to the British House of Commons as member for Beeralston, and afterward sat for Windsor (1787–96), and for Old Sarum (1796–97). He was appointed governor-general of India in 1797, and in 1799 created Marquis Wellesley in the Irish peerage. His administration was notable, both for its ability and the large accessions of territory made under it by the conquest of Mysore and the humbling of the Mahrattas. In 1809 he became Foreign Secretary under Mr. Perceval. In 1812 he resigned his place chiefly because he was in favor of Catholic emancipation, and did not return to office till 1821, when he became lord-lieutenant of Ireland. This post he retained till 1825, when he was removed from it by his brother, the Duke of Wellington, who was an opponent of emancipation and had become Prime Minister. In the Grey ministry he held the office of lord-steward till 1833, when he again became lord-lieutenant of Ireland. Displaced in the following year by the Peel ministry, he afterward held the office of lord-chamberlain for a few months of 1835. Consult Martin, 'Indian Despatches, Minutes, and Correspondence of the Marquis Wellesley' (1836–37), and biographies by Torrens (1880), Malleson (1889) and Hutton (1893).

WELLESLEY, Mass., town in Norfolk County, on the Boston and Albany Railroad, 14 miles west of Boston. It was incorporated as a town in 1881, and includes the villages of Wellesley, Wellesley Hills and Wellesley Farms. It is principally a residential town, with many broad streets and handsome residences. It is the seat of Wellesley College (q.v.), and also of Dana Hall, a secondary school for girls; Wellesley School and Rock Ridge Hall, secondary schools for boys; and two Roman Catholic academies, the Academy of the Assumption for girls and Saint Joseph's Academy for boys. There is also a public high school at Wellesley Hills, founded in 1865, and a public library of about 20,000 volumes. There is a weekly newspaper and three college publications. The government is vested in the town-meeting and the selectmen, chosen annually. The waterworks are owned and operated by the town. Pop. 6,439.

WELLESLEY COLLEGE, a college for women located at Wellesley, Mass. It was founded by Henry F. Durant to give "to young women opportunities for education equivalent to those usually provided in colleges for young men." The charter was obtained in 1870, and the college first opened to students in 1875. It is non-sectarian in control; three representatives of the alumnæ serve on the board of trustees. In 1894 the system of elective courses was established which with some recent modifications is still in force. The college confers one baccalaureate degree, A.B., and the graduate degree, A.M. Certain courses are required in mathematics, philosophy, hygiene, Bible history, English, some foreign languages and natural sciences; in addition to the required studies every candidate for the degree must take a sufficient amount of elective work to complete the equivalent of 59 one-hour courses, a one-hour course being a course given once a week for one year. Of these electives 18 one-hour courses must be taken in one of the following ways: 9 in each of two subjects, related or unrelated; 12 in one subject with six in a tributary subject. Pedagogical courses are offered in the history and science of education and in methods of teaching; art and music are included in the curriculum; the courses in history and theory in both departments count toward the degree; studio work in art counts toward the degree after one course in history is completed; the regular practical work in music does not count toward a degree. A full course in music leading to the certificate of the department may be taken by candidates for the A.B. degree who remain at the college five years. The college contributes toward the support of the American School of Classical Studies in Athens, the American School of Classical Studies in Rome, the Marine Biological Laboratory at Wood's Holl and the women's table at the Zoological Station at Naples. There are 61 scholarships for undergraduates and one graduate fellow-

ship. The students maintain literary and dramatic societies. The campus has a particularly beautiful situation within the limits of the town; it includes a lake which affords excellent opportunity for rowing and skating; on this lake is held the annual "Float." The buildings include the Farmsworth Art Building, Whitin Observatory, Houghton Memorial Chapel Library, Billings Hall for Music, Mary Hemenway Hall for Physical Training, a President's House, Simpson Infirmary, Page Memorial Kindergarten, Guest House and 16 halls of residence; also temporary buildings for administrative, lecture and laboratory purposes, pending the completion of a liberal arts building now under construction and other members of proposed academic group. Productive funds equal $2,783,969.83; special building and equipment funds, $953,677.84. The library contains 87,000 volumes, including the Gertrude Memorial Library, the Library of American Linguistics and other special and departmental libraries. The students in 1918 numbered 1,600 and the faculty 137; about 42 per cent of the graduates have become teachers.

WELLESLEY ISLANDS, Australia, in Gulf of Carpentaria, are politically attached to Queensland. Mornington, the northernmost and largest island, is 40 miles long by 15 miles broad.

WELLHAUSEN, vĕl'how-zĕn, **Julius,** German Orientalist and Biblical scholar: b. Hameln, Hanover, 17 May 1844. He studied theology in the University of Göttingen, in 1872 was appointed professor of theology in Greifswald University, but resigned in 1882 because he could no longer hold the accepted views of Scriptural inspiration. He went to Halle as extraordinary professor of Oriental languages and in 1885 was appointed to an ordinary professorship at Marburg, whence in 1892 he removed to Göttingen to occupy a similar post. In 1871 he published a text-critical work on the books of Samuel, and in 1874 appeared his treatise 'Die Pharisäer und die Sadducäer.' The first volume of a 'Geschichte Israels' was issued in 1878 and a second edition of it in 1883, under the title, 'Prolegomena zur Geschichte Israels' (5th ed., 1899). The 'Prolegomena' was translated into English in 1885 by Black and Menzies, with a preface by W. Robertson Smith, the volume containing also a reprint of his article 'Israel' contributed to the 'Encyclopædia Britannica' (9th edition). The last-mentioned article was published separately in 1881 as a 'Sketch of the History of Israel and Judah' (3d ed., 1891), and included in a German form, as an 'Abriss der Geschichte Israels und Judas,' in the 1st volume of his 'Skizzen und Vorarbeiten' (1884–92). The 'Abriss' was amplified to form a work on 'Israelitische und Jüdische Geschichte' (1894; 4th ed. 1901). His masterly treatise on 'Die Composition des Hexateuchs und der Historischen Bücher des Alten Testaments' (1885; 3d ed. 1899) originally appeared in the 'Jahrbücher für Deutsche Theologie' (1876–77). Later works are 'Muhammed in Medina' (1882); 'Der Arabische Josippus' (1897); 'Reste Arabischen Heidentums' (2d ed. 1897), first published in the 'Skizzen und Vorarbeiten'; 'Die Kleinen Propheten übersetzt, mit Noten' (1892; 3d ed. 1898); different books on the evangelists ('Mark' 1903); 'Matthew' (1904); 'Luke' (1904); 'John' (1908); and 'Einleitung in die drei ersten Evangelien' (1905); 2d ed. 1911).

WELLING, James Clarke, American educator: b. Trenton, N. J., 14 July 1825; d. Hartford, Conn., 4 Sept. 1894. He was graduated from Princeton in 1844, was appointed associate principal in the New York Collegiate School in 1848 and in 1856–65 was literary editor of the Washington *National Intelligencer.* He was clerk of the United States Court of Claims in 1862–67, in 1867–70 was president of Saint John's College, Annapolis, Md.; occupied the chair of belles-lettres at Princeton in 1870–71; and in 1871–94 was president of Columbian University, Washington, D. C. He was a regent of the Smithsonian Institution, president of the Corcoran Gallery of Art and also of the Philosophical and the Anthropological Societies of Washington.

WELLINGTON, Arthur Mellen, American civil engineer: b. Waltham, Mass., 20 Dec. 1847; d. New York, 16 May 1895. Defective eyesight prevented his entering a university but he studied civil engineering under Prof. J. B. Henck in Boston. He was later associated with the laying out of Prospect Park, Brooklyn, and from 1868 was a railroad engineer. In 1881–84 he was chief engineer of the Mexican National and the Mexican Central railroads. He was the author of the plan for multiplying the traffic facilities of Brooklyn Bridge by five times, recommended by the Board of Experts in 1887. In 1884–87 he was and editor of the *Railroad Gazette;* and from 1887 until his death he was one of the editors and owners of the *Engineering News.* He was also active as a consulting engineer in many important public works, among them the plans for the Boston Subway and the abolition of grade crossings in Buffalo. Author of 'Computations from Diagrams of Railway Earthworks' (1878); 'Field Work of Railway Location and Laying out of Works' (1889).

WELLINGTON, Arthur Wellesley, DUKE OF, British soldier and statesman: b. 1769; d. Walmer Castle, England, 14 Sept. 1852. He was the fourth son of the 1st Earl of Mornington. His mother was the eldest daughter of the 1st Viscount Dungannan. He was educated at Eton, privately at Brussels, and finally at the Military College of Angers. On 7 March 1787 he received a commission as ensign in the 73d Foot. He was gazetted under the name of Wesley, the family name till changed by his brother to Wellesley. After a rapid series of changes and promotions he attained by purchase in September 1793 the command as lieutenant-colonel of the 33d regiment in which he had attained his majority in April of the same year. In 1790 he was returned to the Irish Parliament for the family borough of Trim, in the county of Meath. In May 1794 he sailed with his regiment for Flanders to join the army of the Duke of York. In 1796 he joined his regiment at the Cape, arrived at Calcutta in February 1797, and was attached to the Bengal service. Later the 33d regiment was attached to the Nizam's contingent in the Deccan with Wellesley in command. The army

entered Mysore in March 1799. An engagement took place at Mallavelly on the 27th, in which Wellesley, who commanded the left wing, turned the right of the enemy. He was subsequently employed to dislodge the enemy from their posts in front of Seringapatam and after the capture of that capital was appointed July 1799, to its command. During his administration he was compelled to take up arms against Dhundiah Waugh, a robber chief, who styled himself "King of the Two Worlds." Wellesley overtook and routed him with a small body of cavalry 10 Sept. 1800. In April 1802 Wellesley attained the rank of major-general. Early in 1803 he was appointed to the command of a force destined to restore the Peshwa of the Mahrattas, driven from his capital by Holkar. This operation successfully performed, the other Mahratta chiefs, Scindia and the Raja of Berar, showed hostile designs against the British and Wellesley was appointed to the chief military and political command in the operations against them. After an active campaign, in which he took Ahmednagar and Arungabad, he encountered a powerful Mahratta army, assisted by French officers, at Assaye (23 September) and entirely defeated it. The parallel successes of General Lake, and the defeat of the Raja of Berar by Wellesley at Argaum on 29 November, compelled the submission of the Mahrattas and peace was restored on conditions drawn up by the successful general. The fame of Wellesley's achievements had now spread over India. Before leaving Madras he received his appointment as K.C.B., and the thanks of both houses of Parliament. He sailed for England on 10 March 1805 and arrived in September.

On 10 April 1806 Wellesley married Lady Catherine Pakenham, third daughter of the Earl of Longford. He had previously been elected and distinguished himself in the House of Commons by the defense of his brother's administration in India. In April 1807 he was appointed chief secretary for Ireland and in August received the command of the reserve in the expedition to Copenhagen under Lord Cathcart and Admiral Gambier. He took Kioge 29 April, the only land operation of importance. On returning he resumed his duties as secretary and received the thanks of Parliament for his share in the expedition. On 25 April 1808 he attained the rank of lieutenant-general.

In June, Wellesley received the command of a force destined to operate in the north of Spain and Portugal in aid of the revolt against Napoleon. On 30 July he anchored in Mondego Bay, and landed his troops at Figueira. The English began their southward march on 8 August. Wellesley moved on the coast road to Torres Vedras. At Roliça he encountered about 5,000 men under Delaborde, whom Junot had sent in advance to arrest his progress. This corps, after a spirited resistance, was driven back and retired to Torres Vedras. Wellesley now drew nearer the coast, reaching Vimeiro on the 19th, where he was reinforced by two brigades from England, raising his force to 17,000. At the same [illegible] superseded in the command. The [illegible] had determined to increase their army in the Peninsula, and had appointed Sir Hew Dalrymple to the chief command, with Sir Harry Burrard as second and Wellesley, Moore, Hope, Paget and Fraser as divisional commanders. Junot determined to attack the English on the land side while they were in the immediate neighborhood of the sea. The attack was made on 21 August and Junot was beaten. After the battle Junot proposed an armistice, the result of which was the famous Convention of Cintra, by which the French agreed to evacuate Portugal on condition of being conveyed to France with their arms and baggage. Public feeling in England over the excessive liberality of the terms ran so high that the generals were recalled to be examined by a board of inquiry, but their conduct was approved of and commended. Wellesley proceeded to Ireland in December as chief secretary, and early in 1809 received the thanks of both houses of Parliament for his conduct of the campaign.

In the latter part of 1808 Napoleon overran Spain with 200,000 men, and Sir John Moore, pursued by Soult, carried the British army to Coruña, where it embarked for England. Lisbon was still held by Sir John Cradock and a British force occupied Cadiz, when Wellesley was appointed to assume the chief command in the Peninsula. He arrived at Lisbon 22 April 1809. He advanced against Soult at Oporto and the French were thrown into confusion and retreated precipitately. Soult now retired to Galicia, followed by Wellesley to the frontiers of Portugal and harassed by the insurgent Portuguese. The Peninsula was at this time occupied by about 250,000 French troops; but after the departure of Napoleon the independence or insubordination of the French marshals prevented effective co-operation of the different armies, and the French command never extended beyond the districts occupied by their armies. The British commander had a series of difficulties to contend with. First was the smallness of the armies on which he could rely. The numbers of the British were always comparatively insignificant and reinforcements were slowly and scantily supplied. Almost as formidable was the difficulty of co-operating with his allies. Spain and Portugal were without regular governments. The Portuguese officers had mostly fled to Brazil, but the Portuguese troops, carefully drilled by Beresford and placed under the command of British officers, soon became a tractable and efficient force. It was far otherwise with the Spaniards. The junta and the generals were alike ignorant, incompetent and self-conceited and with the raw levies which constituted the Spanish armies it was positively dangerous to co-operate. Even with the Portuguese government, Wellington (as he must now be called) had natural but formidable difficulties to contend with. The subsistence of the armies was a constant source of danger and embarrassment both in Spain and Portugal. The resources of the country were oppressed by the armies of three nations. The French took all they wanted and wasted much more. The Spanish armies, numerous and inefficient, were a sufficient weight for the junta, which always supplied with reluctance the wants of the British who had commonly much greater

difficulty in procuring provisions for money than either of the other armies had in seizing them. Through all these difficulties Wellington adhered with undeviating patience and constancy to the strict principles of discipline he had laid down. He remonstrated with herculean labor, and with admirable spirit, as his dispatches show, with authorities of all kinds; but he never under the great temptation took, or suffered others to take, violent means to supply his most pressing wants.

By a misunderstanding between Soult, who held the command in the north of Spain, and Ney, who was under him, Galicia was evacuated by both marshals and never afterward recovered, a valuable result of Wellesley's first campaign. To co-operate with the Spanish armies, Wellesley had determined to advance into Spain, which he did in July by the north of the Tagus. Nearly every important fortress in Spain was in the hands of the French.

The victory of Talavera, 27–28 July, earned Wellesley the titles of Baron Donro and Viscount Wellington. Next day the French retreated across the Alberche and broke up their army. The first invasion of Spain had resulted in nothing but a series of movements among the French troops. Wellington at this time surveyed the lines of Torres Vedras and formed his plan of fortifications for their defense. Anticipating that invasion would come from the north, he left General Hill to guard the Tagus and fixed his headquarters at Viseu.

The French in the meantime were largely reinforced. Soult was in Andalusia with 60,000 men threatening the south of Portugal, while in the north the army of Portugal was concentrating to the extent of 70,000 to 80,000, and the veteran Masséna was appointed to command it. Wellington was able to bring into the field from 50,000 to 60,000 British and Portuguese troops. The French invested the Spanish fortress of Ciudad Rodrigo early in June and took it on 10 July. They then advanced to the Coa, from which the British retired. Almeida was captured on 27 August. Wellington fell back on the valley of the Mondego. In the middle of September, Masséna began his march down the right bank of the river. At the Sierra de Busaco, a high ridge in front of Coimbra, Wellington made a stand and repulsed the French. After the battle, Masséna turned Wellington's position, who retreated to Leiria, where he halted two days. On 8 October he entered his lines, just as the autumnal rains were beginning to fall. A powerful fleet and a flotilla of gunboats on the Tagus contributed to their defense. Masséna was wholly unprepared for his reception and after some vain demonstrations he retired from their front. The Portuguese parties had cut off his communications with Spain and sickness was rapidly diminishing his numbers. On 15 November he fell back to Santarem.

Napoleon recommended to waste the English with continual engagements of advanced guards and sent Soult instructions to co-operate with Masséna. But Soult, with the blockade of Cadiz and with the Spaniards on his hands, could ony spare a sufficient force to besiege Badajoz. In March 1811 Masséna was compelled to begin his retreat, which he conducted with great skill. The French crossed the Agueda on 6 April. Wellington estimated their loss in the campaign at not less than 45,000. Wellington blockaded Almeida and cantoning his army between the Coa and the Agueda, returned to Badajoz, which had been taken by Soult and invested by Beresford. He was speedily recalled by an aggressive movement of Masséna to relieve Almeida. Wellington took up a position to cover the fortress at Fuentes de Onoro, where he was attacked by Masséna with a superior force. In this battle he performed the exceedingly critical operation of changing his front in presence of the enemy. The manœuver was successful and Masséna was repulsed. Almeida surrendered a few days after the battle and Masséna was about the same time superseded by Marmont. Soult in the meantime had been defeated by Beresford at Albuera in an attempt to relieve Badajoz. Wellington returned to prosecute the siege and Marmont also moved south to join Soult, but afterward returned to Salamanca. This induced Wellington to push the siege of Ciudad Rodrigo in preference to that of Badajoz and he returned to the Agueda. Marmont, however, advanced with a superior force and he withdrew to the Coa. Marmont returned to Salamancas.

During the winter Wellington continued to occupy himself with preparations for this siege, collecting his stores at Almeida under pretext of repairing it. On 6 Jan. 1812, he moved his headquarters to Gallegos, invested Ciudad Rodrigo on the 8th and took it by assault on the 12th. An earldom, a pension and a Spanish dukedom awarded this achievement. Wellington now went south with his principal force to take Badajoz; and Marmont, who had collected his forces to raise the siege of Ciudad Rodrigo, invaded Portugal by Sabugal and ravaged the country. Badajoz was taken on 6 April, with a heavy loss. Having secured the frontier fortresses, Wellington determined again to invade Spain. Leaving Hill on the southern frontier he moved north with his main army and on 17 June reached Salamanca, Marmont retiring to Toro. The French general, when he had concentrated his forces, attempted by a series of pretentious manœuvres to surprise the British commander, his ultimate object being to cut him off from his communications. With this purpose he crossed the Tormes, followed by Wellington, who took up his position between the river and two hills called the Arapiles. Here Marmont's overdisplay of tactics recoiled on himself. Having gained the outer Arapile, in extending his left to attack the British right, he gave Wellington the opportunity he had long desired of attacking him. Marmont was wounded and the French left and centre broken. Clausel, who attempted to re-form the army, was routed. Numerous prisoners were taken by the cavalry in pursuit and the French retired to Burgos. Wellington reached Valladolid on 31 July and turning on Joseph, who had advanced to support Marmont, followed him to Madrid, which he entered on 12 August. Hill was now advancing to join Wellington and Joseph fell back from Toledo to Almansa in Murcia. These successes compelled Soult to abandon Andalusia and an Anglo-Spanish force from Cadiz took Seville. Wellington's next movement was against the army he had defeated under Clausel, which had been largely reinforced. He left Hill in Madrid (1 September) and advanced to Burgos, being joined on his

way by a body of Spaniards. The French retired, leaving a garrison in the castle, which Wellington deemed it necessary to take before advancing. The siege, for want of proper artillery, occupied him till 21 October. In the meantime the northern army under Souham was again advancing and Soult with a powerful army marching on Madrid, which Hill had abandoned to fall back on Salamanca. Wellington abandoned the siege and retreated, closely followed by the French, who repeatedly attacked his rear. At Palencia he was joined by a brigade from England. At Tudela, Souham halted to wait for Soult and Wellington proceeded to the Tormes, where he was joined by Hill, and when the French crossed the Tormes in force he took up his old position at the Arapiles. The united armies of Soult and Souham amounted to nearly 90,000 men. Wellington's strength was over 50,000. The enemy, instead of attacking, threatened his communications, upon which he retreated to the Agueda and established his headquarters at Ciudad Rodrigo. The French, not being prepared to invade Portugal, withdrew their armies to cantonments in Castile. General Hill's corps continued to occupy Estremadura and the rest of the British were cantoned on the Portuguese frontier.

The gains of this campaign were substantial. The French had not only been compelled to reinforce their Spanish armies largely at the expense of their operations elsewhere, but had lost Andalusia and given the British a footing in Estremadura. Wellington received (18 August) the title of marquis and Parliament voted him thanks and £100,000. The failure of the Russian campaign compelled Napoleon to recall Soult from Spain and Wellington was able to open the campaign of 1813 with a force of 70,000 British and Portuguese. He had also been appointed commander-in-chief of the Spanish armies. He opened the campaign in May by an advance in the former direction and on 12 June reached Burgos, the French retreating to the Ebro. Wellington turned their position by crossing the Ebro near its source and after some unsuccessful fighting they fell back on Vittoria. In a strong position commanding the principal roads through the town they were defeated by the British on 21 June. Being driven from the town, while the British left had seized the Bayonne road, by which they retreated, they were thrown into confusion and routed. Wellington now occupied the passes of the Pyrenees and besieged Pampeluna and San Sebastian. He was created field-marshal and received the Spanish title of Duke of Vittoria. Soult was dispatched by Napoleon, with the title of lieutenant of the emperor, to restore matters in the Peninsula. He had still a powerful army (80,000), but after a series of engagements, called the battles of the Pyrenees, he retreated into France. Some time being spent in pushing the sieges of Pampeluna and San Sebastian, the former of which surrendered 31 August, the latter 31 October, Wellington crossed the Bidassoa in October and in November the whole army descended from the Pyrenees into the French plains. Some severe fighting occurred before the armies went into winter cantonments. On 27 February Wellington defeated Soult at Orthez and the French retreated to Toulouse. Suchet had abandoned Catalonia and reached Narbonne. Another engagement took place in front of Toulouse on 10 April, in which the French after severe fighting were driven into the town. Next day, Soult evacuated Toulouse and Wellington entered it on the 12th. In the afternoon news arrived of Napoleon's abdication, but Soult declined to submit to the provisional government without further advice and Wellington refused an armistice. Advices having arrived from Berthier, Soult entered into a convention on 18 and Suchet on 19 April. In a sortie of the garrison of Bayonne, before the peace was known, the British suffered severely. On 30 April Wellington, leaving his army in quarters, set out for Paris. In May he had to visit Madrid to allay political differences among the Spanish generals and on 14 June he issued farewell orders to his army. He was created Marquis of Douro and Duke of Wellington in May, with an annuity of £13,000, commutable for £300,000, afterward £400,000. He received the thanks of both houses of Parliament. In July he went as Ambassador to France and he succeeded Lord Castlereagh as British representative in the Congress of Vienna. In April he took the command of the army assembled in the Netherlands to oppose Napoleon. (See FRANCE; NAPOLEON I; WATERLOO). On his return to England after the restoration of peace he received a vote of £200,000 for the purchase of the estate of Strathfieldsaye, to be held on presenting a colored flag at Windsor on 18 June each year. Numerous foreign honors were showered upon him; among others he was made field-marshal of the armies of France, Russia, Austria and Prussia.

With the return of peace he resumed the career of politics. He accepted the post of Master-General of the Ordnance with a seat in the Cabinet of Lord Liverpool in January 1819. In 1822 he represented Great Britain in the Congress of Vienna. In 1826 he was appointed high-constable of the Tower and went to Saint Petersburgh as Ambassador on the affairs of Greece. On 22 Jan. 1827 he succeeded the Duke of York as commander-in-chief of the forces. On the accession of Canning to office (April 1828) he set the bad example of resigning this post on political grounds. He resumed it again on the accession of Lord Goderich. On 8 Jan. 1828 he accepted the premiership and, resigning the command of the forces, gave it to Lord Hill. During his first year of office he carried the repeal of the Test and Corporation Acts. In January 1829 he was appointed governor of Dover Castle and lord warden of the Cinque Ports. This year he carried the Catholic Emancipation Bill. Both this and the repeal of tests were reforms which he had steadfastly opposed and which he yielded to necessity rather than conviction. He fought a duel in defense of his conduct on this bill with Lord Winchilsea on 21 March. In 1830 repeated motions for parliamentary reform were defeated, but the growing discontent throughout the country on this subject and a defeat in Parliament caused the resignation of the government in November. His opposition to reform made the duke so unpopular that he was assaulted by a mob on 18 June 1832 and his life endangered. He accepted the office of Foreign Secretary under Sir Robert Peel, 9 Dec. 1834, and retired with him, 8 April 1835. In the Peel ministry in 1841 he took a seat in the Cabinet without office. On 10 Dec. 1842, on the death of Lord Hill, he resumed the

command of the forces, which he held till his death. On the return of Peel to office in 1846 he supported him in carrying the repeal of the corn-laws, which up till then he had opposed. From this time his general policy in Parliament was to support the government of the day.

Bibliography.— 'Wellington's Despatches, 1779–1815,' edited by Colonel Gurwood (1834–39); 'Supplementary Despatches and Memoranda, 1794–1818,' edited by Wellington's son (1858–72); 'Civil and Political Despatches, 1819–32,' edited by Wellington's son (1869–80); 'Speeches in Parliament,' edited by Gurwood (1854); the 'Lives' by Brialmont (1856–57); Gleig (1858–60); Hamley (1860); Browne (1888), composed of extracts from the records; Hooper (1889); Maxwell (1899); and those of Wright and Yonge. Consult also Griffiths, 'Wellington and Waterloo'; Napier, 'History of the Peninsular War'; Ropes, 'Campaign of Waterloo'; Oman, 'History of the Peninsular War' (1902); and Roberts, 'Rise of Wellington' (1895); Robinson, C. W., 'Wellington's Campaigns' (London 1908); Fitchett, W. H., 'The Great Duke' (New York 1912). See also INDIA; PENINSULAR WAR; SPAIN.

WELLINGTON, Chile, an island off the west coast of Magallanes Territory, 138 miles long and 35 miles wide. Its northernmost extremity is Cape San Roman.

WELLINGTON, Kan., city and county-seat of Sumner County, situated in the south central part of the State, near the southern boundary, on Slate Creek and on the Atchison, Topeka and Santa Fé, the Southern Kansas and the Chicago, Rock Island and Pacific railroads. It was first settled in 1871; and became a city of the third class in 1876 and a city of the second class in 1880. It is situated in an agricultural region and carries on an important export trade in grain and other agricultural products; it contains grain elevators, three flouring mills, plow works, an ice factory and the shops of the Atchison, Topeka and Santa Fé Railroad. There are three banks and a daily and three weekly newspapers. It is the seat of the Sumner County High School. The city government is vested in a mayor and a council of 10 members, half of whom are elected each year; the city owns the waterworks and the electric-light plant. Pop. 5,642.

WELLINGTON, New Zealand, (1) The capital city of New Zealand and also the provincial district of Wellington, situated on Lambton Harbor, on the southwest of Port Nicholson, an inlet of Cook Strait, about 1,200 miles southeast of Sydney in Australia. Its fine harbor is the safest and most commodious in New Zealand. It receives most of the direct sea trade of New Zealand. The principal buildings and institutions are government house, a fine building in Italian style, said to be the largest wooden structure in the Southern Hemisphere; the houses of legislature (the parliamentary library building was destroyed by fire 10 Dec. 1907); the government building; Supreme Court edifice; Anglican, Roman Catholic, Wesleyan, Primitive Methodist, Presbyterian, Congregational and other churches; a free public library; Wellington College, a girls' high school, Saint Patrick's College (R.C.), a technical school and other similar educational institutions; Victoria University College, affiliated to the University of New Zealand; a general hospital; a lunatic asylum; the Boys' Institute; and the botanical gardens. The city is lighted by electricity and has a good water supply and its streets are traversed by electric tramways. The chief industrial establishments are tanneries, candle and soap works, coffee-mills, boot factories, biscuit works, foundries, brick-works, saw-mills, woolen-mills, breweries and meat-packing establishments. The town has a harbor that has been improved and fortified. Unlike most New Zealand towns, this one is built of wood, owing to the volcanic nature of its site, where several earthquakes have already occurred. The foreign trade increases steadily, being double in 1912 the figure of 1908 and nearly 70 per cent greater in 1916 than in 1912. The 1916 total was $84,000,000. The population has grown from 69,000 in 1909 to 97,000 in 1919. (2) A provincial district in the south of North Island; area, 10,807 square miles. Its coast is but little indented, the principal openings being Palliser Bay and Port Nicholson in the south. It is traversed throughout almost its whole length by a range of mountains, averaging about 4,000 feet in height. Parallel to this main range and nearer the east coast there is a series of lower ranges and between these two chief mountain systems extends the broad Wairarapa Plain, merging northward into an undulating country. A considerable extent of fairly level country, increasing in breadth northward, is also found along the west coast. The district is well-watered by several rivers and in the south are Lakes Wairarapa and Onoke. Wellington is well-wooded and timber is one of its chief exports. Much of the surface is admirably adapted for pastoral purposes and there are in the district several million sheep, in addition to large numbers of cattle and horses. Agriculture is also successfully carried on in several parts, the principal crops being oats, wheat, potatoes and turnips. The number of cheese and butter factories is steadily increasing. Little mineral wealth has been found in the district of Wellington, but some gold has been worked. Railways run from Wellington to Napier and New Plymouth. Pop. 232,114.

WELLINGTON, Ohio, village in Lorain County, on the Wheeling and Lake Erie, the Cleveland, Cincinnati, Chicago and Saint Louis and other railroads, about 35 miles southwest of Cleveland. It is the commercial centre of a farm and dairy section. It is noted for its large annual shipments of cheese. It has flour mills, lumber mills, a foundry and in the vicinity are a number of butter and cheese factories. There are two banks and a newspaper. Pop. about 2,131.

WELLMAN, Walter, American journalist and explorer: b Mentor, Ohio, 3 Nov. 1858. He obtained a secondary education in Michigan in 1879, established the *Evening Post* of Cincinnati and from 1884 was political and Washington correspondent of the Chicago *Herald* and *Record-Herald*. In 1892, after investigation of the subject, he located the landing place of Columbus in the New World on Watling Island (San Salvador) in the Bahamas and built a monument on the spot as he had determined it. He led an expedition to the Arctic regions in 1894, reaching lat. 81°, northeast of Spitzbergen, and in 1898–99 a second expedition,

reaching lat. 82° and discovering many islands. He wintered in Franz Josef Land and in the spring of 1899 made an unsuccessful dash for the pole. In May 1899, a party directed by E. B. Baldwin (q.v.), a member of the expedition, discovered Graham Bell Land. In 1910 he undertook to cross the Atlantic Ocean in a balloon, starting from Atlantic City, N. J. A long sausage-like sea-anchor was trailed from the balloon to the water but proved an unsatisfactory device. After traveling 1,010 miles and breaking what was then the world's record, Wellman and his companions were picked up by the steamship *Trent*, 375 miles east of Cape Hatteras. His writings include an exposé of Dr. Cook's claim to polar discovery and many magazine articles.

WELLS, Amos Russel, American editor and author: b. 23 Dec. 1862 at Glens Falls, N. Y. He graduated at Antioch College in 1883. He was professor of Greek and geology at Antioch College 1883–91 and from 1891 editor of the *Christian Endeavor World*, Boston. From 1901 he was associate author of 'Peloubet's Notes on the Sunday School Lessons.' He is a member of the International Sunday-School Lesson Committee. He is a voluminous author, no less than 63 titles being credited to his pen. They include books dealing with young people's work, the Sunday school, juvenile fiction, poetry and devotional literature.

WELLS, Benjamin Willis, American journalist and author: b. Walpole, Cheshire County, N. H., 31 Jan. 1856. He was graduated from Harvard in 1877, studied also at Berlin, was a Fellow of the Johns Hopkins University, in 1891–98 he was professor of modern languages in the University of the South (Sewanee, Franklin County, Tenn.) and from 1899 to 1912 he was a member of the staff of *The Churchman* (New York). His chief publications are 'Modern German Literature' (1895); 'Modern French Literature' (1897); and 'A Century of French Fiction' (1898), historical and critical studies. He also edited numerous German and French texts, contributed largely to encyclopedias and periodicals, and edited (with W. P. Trent) 'Colonial Prose and Poetry' (1902), an anthology.

WELLS, Carolyn, American humorous writer: b. Rahway, N. J., about 1873. She took up literary work in 1895, and her many publications, which are chiefly for juvenile readers, include 'At the Sign of the Sphinx' (1896); 'The Story of Betty' (1899); 'Folly in Fairyland' (1901); 'Eight Girls and a Dog' (1902); 'The Pete and Polly Stories' (1902); 'Rainy Day Diversions' (1907); 'The Clue' (1909); 'The Lovers' Baedecker' (1912); 'The Maxwell Mystery' (1913); 'Anybody but Anne' (1914); 'Bride of a Moment' (1916); 'Faulkner's Folly' (1917); 'The Room with the Tassels' (1918).

WELLS, Charles Jeremiah, English poet: b. probably London, about 1799; d. Marseilles, France, 17 Feb. 1879. He was a schoolfellow of a younger brother of the poet John Keats, and was the subject of a sonnet by the poet; later, however, he lost his friendship, as well as that of Haslitt. He wrote extensively but not successfully, and upon his wife's death he destroyed most of his work. He was for a time a solicitor in London, but retired to Wales about 1830, removed to Hertfordshire in 1835, and after 1840 lived abroad. Of his work there remains a volume of prose 'Stories After Nature' (1822; reprinted 1891); and the Biblical drama, 'Joseph and His Brethren' (1824). The drama met with little favor until it came to the notice of Rossetti in 1863 and was warmly praised by him, a judgment later confirmed by Swinburne. It was reprinted in 1876 and brought a considerable meed of praise to the author in his last years.

WELLS, David Ames, American political economist: b. Springfield, Mass., 17 June 1828; d. Norwich, Conn., 5 Nov. 1898. He was graduated from Williams College in 1847, and from the Lawrence Scientific School in 1851, but before entering the latter institution had been assistant editor of the Springfield *Republican*, and was one of the promoters of the invention of a mechanism for folding books and newspapers in connection with the printing press. In 1851 he was appointed assistant professor at the Lawrence Scientific School, and was also lecturer on chemistry and physics at Groton Academy; during this earlier period of his life he published several textbooks on the natural sciences. He first attained reputation as a political economist by an address on 'Our Burden and Our Strength,' read before a literary society of Troy in 1864; it discussed the resources of the United States in regard to the nation's debt-paying ability, and attracted the attention of the President, who summoned him to a conference in regard to the national finances. This resulted in the creation of a commission of three for the investigation of questions of taxation and revenue, of which commission Wells was chairman. In this capacity he was the first to collect economic and financial statistics for government use. In 1866 he was appointed to the office of special commissioner of revenue, was instrumental in abolishing the many petty taxes which had been imposed during the war, and originated most of the important forms and methods of internal revenue taxation adopted from 1866 to 1870. In the latter year the office which he held was abolished. He had at first been an advocate of the protectionist policy, but after a visit to Europe and a careful study of the English system, he changed his views, and advocated the system of free trade. In 1876 he was an unsuccessful candidate for Congress on the Democratic ticket. He published 'Our Burden and Our Strength' (1864); 'The Creed of the Free Trader' (1875); 'Why We Trade and How We Trade' (1878); 'The Silver Question or the Dollar of the Fathers *vs.* the Dollar of the Sons' (1878); 'Our Merchant Marine; How it Rose, Increased, became Great, Declined and Decayed' (1882); 'A Primer of Tariff Reform' (1884); 'Practical Economics' (1885); 'Relation of Tariff to Wages' (1888); 'Recent Economic Changes' (1898). His writings are notable for their clear and forcible presentation of a vast number of details and statistics.

WELLS, Frederic Lyman, American psychiatrist: b. Boston, Mass., 22 April 1884. He was graduated at Columbia University in 1903 and took his Ph.D. there in 1906. He was connected with the faculty at Columbia University

in 1905–07 and in 1910–11; was assistant pathological psychologist at the McLean Hospital, Waverly, Mass., in 1907–10 and in 1911–17; and was connected with the Psychiatric Institute, Ward's Island, New York, in 1910–11. He was commissioned captain of the Signal Reserve Officers' Corps, 18 Sept. 1917, and was assigned to active service at Boston, 28 Sept. 1917. Author of 'Mental Adjustments' (1917).

WELLS, Heber Manning, American politician: b. Salt Lake City, 11 Aug. 1859. He was graduated from the University of Utah in 1875, and began early to take an active part in public life. He was recorder of Salt Lake City in 1882–90, and a member of the city board of public works in 1890 and in 1893. He was a member of the constitutional convention which framed the constitution under which Utah was admitted as a State; in 1895 was elected governor of Utah for a five years' term on the Republican ticket, and in 1900 was re-elected for a four years' term. During the prolonged struggle between the mine owners and miners' unions in 1904, he maintained an impartial attitude as far as possible, but firmly opposed anarchy and disorder. In 1905 he retired from politics and engaged in banking business.

WELLS, Herbert George, English author: b. Bromley, Kent, 21 Sept. 1866. He was educated at the Royal College of Science (South Kensington, London), published a 'Text-Book on Biology' (1892–3), and followed this by a series of works of fiction in which science and mechanics are employed for the accomplishment of various wonders narrated in the circumstantial and plausible manner of Verne. In his later years he was more versatile, and displayed a tendency to discuss mystic and social subjects in the form of fiction. He has made a place for himself in the very front rank of modern writers. Among them are 'The Time Machine' (1895); 'Select Conversations with an Uncle' (1895); 'The Wonderful Visit' (1895); 'The Island of Dr. Moreau' (1896); 'The Wheels of Chance' (1896); 'Thirty Strange Stories' (1897); 'The Invisible Man' (1897); 'The War of the Worlds' (1898); 'Tales of Space and Time' (1899); 'When the Sleeper Wakes' (1899); 'Love and Mr. Lewisham' (1900); 'Anticipations' (1901); 'The First Men in the Moon' (1901); 'Mankind in the Making' (1903); 'Twelve Stories and a Dream' (1903); 'The Food of the Gods' (1904); 'A Modern Utopia' (1905); 'Kipps' (1905); 'In the Days of the Comet' (1906); 'The Future in America' (1906); 'This Misery of Boots,' a tract in favor of Socialism (1907); 'New Worlds for Old,' an account of Socialism (1908); 'First and Last Things,' a confession of faith (1908); 'The War in the Air' (1908); 'Tono Bungay,' a novel of contemporary life (1909); 'Ann Veronica' (1909); 'The History of Mr. Polly' (1910); 'The New Machiavelli' (1911); 'Floor Games for Children' (1911); 'Marriage' (1912); 'Little Wars,' a floor game book (1913); 'The Passionate Friends' (1913); 'The Wife of Sir Isaac Harman' (1914); 'An Englishman looks at the World' (1914); 'The World Set Free' (1914); 'The War that will end War' (1914); and 'The Peace of the World' (1915), war pamphlets; 'Boon,' under the pseudonym Reginald Bliss (1915); 'Bealby' (1915); 'The Research Magnificent' (1915); 'What is Coming?' (1916); 'Mr. Britling Sees it Through' (1916); 'The Elements of Reconstruction,' under the pseudonym D. P. (1916); 'War and the Future'; 'God, the Invisible King'; 'The Soul of a Bishop' (1917); 'The Idea of a League of Nations' (1919). His short stories were reprinted in a definitive collection under the title of 'The Country of the Blind' (1911), and many of his works have been translated into other languages.

WELLS, Horace, American dentist: b. Hartford, Vt., 21 Jan. 1815; d. New York, 24 Jan. 1848. He studied dentistry in Boston and practised it there until 1836, then went to Hartford, Conn. For years he made investigations and experiments in search of an agent for preventing pain in the extraction of teeth, and finally became convinced that he had found such an agent in nitrous-oxide gas. In 1844 he made a practical test by having one of his own teeth extracted while he was under the influence of his supposed anæsthetic and the operation confirmed his belief in the discovery. Thenceforth he used nitrous-oxide gas in his practice. He published 'A History of the Application of Nitrous Oxide Gas, Ether and Other Vapors to Surgical Operations' (1847). His claims to the discovery of anæsthesia were controverted in the interest of G. Q. Colton, C. T. Jackson, W. T. G. Morton and J. C. Warren (qq.v.), to each of whom some of the honors of its introduction belong. Wells may have had a predeceessor in C. W. Long (q.v.), but with regard to the first surgical use of an anæsthetic, all other names must yield priority to his. He became mentally unbalanced while advocating his claims in New York, was taken into custody and committed suicide. A statue of Wells stands in Bushnell Park, Hartford, Conn. See ANÆSTHETICS.

WELLS, Horace Lemuel, American chemist: b. New Britain, Conn., 5 Oct. 1855. He was graduated at the Sheffield Scientific School, Yale, in 1877. He became a member of the faculty at Yale in 1884, and since 1894 he has been professor of analytical chemistry and metallurgy there. He has made numerous original investigations in inorganic chemistry, and was elected to the National Academy of Sciences in 1903. Author of 'Studies from the Chemical Laboratory of the Sheffield Scientific School' (1901); 'Chemical Calculations' (1903); 'Textbook of Chemical Arithmetic' (1905), etc.

WELLS, Lemuel Henry, American Protestant Episcopal bishop: b. Yonkers, N. Y., 3 Dec. 1841. He was graduated from Hobart College in 1867, having during the Civil War served as a lieutenant in a Wisconsin regiment and after being graduated from Berkeley Divinity School, Middletown, Conn., took priest's orders in the Episcopal Church in 1871. He was rector of Walla Walla, Wash., 1871–82; of Saint Luke's, Tacoma, 1884–89, and of Trinity, Tacoma, 1889–92. In 1892 he was consecrated missionary bishop of Spokane.

WELLS, Rolla, American capitalist and politician: b. Saint Louis, Mo., 1856. He entered business in the employ of a street railway company and became assistant superin-

tendent and finally general manager of the company. Giving up the latter position in 1883, he became prominently identified with a number of manufacturing and commercial corporations. He has been active in local politics as a Democrat; was a delegate to the Democratic National Convention in 1896 and served two terms as mayor of Saint Louis from 1901 to 1905. His administration was efficient and economical. He took an efficient part in the preparation for the Saint Louis Exposition of 1904.

WELLS, Webster, American mathematician: b. Boston, Mass., 4 Sept. 1851; d. 1916. He was graduated from the Massachusetts Institute of Technology in 1873, pursued special studies in civil engineering and from 1873 was engaged in teaching at the institute, attaining full professorship in 1893. He has written a series of mathematical textbooks, among which are 'Logarithms' (1878); 'Plane and Spherical Trigonometry' (1884); 'Higher Algebra' (1889); 'Complete Trigonometry (1900); 'Text Book of Algebra' (1906), etc.

WELLS, William Charles, British physician: b. Charleston, S. C., 24 May 1757; d. London, England, 18 Sept. 1817. He was the son of a Scottish printer who settled in South Carolina in 1753. He was graduated M.D., at Edinburgh University in 1780, and in 1781 he returned to America to look after his father's property. He supported the cause of the British and for a time after 1782 he published a weekly newspaper at Saint Augustine, Fla. In 1784 he engaged in practice as a physician in London, and from 1800 until his death he was chief physician at Saint Thomas's Hospital. His scientific observations were characterized by keen observation and a sincere devotion to the work. He was elected a Fellow of the Royal Society in 1793 and in 1814 he received the society's Rumford medal for his 'Essay on Dew' (1814). Author of 'An Essay on Single Vision with Two Eyes' (1792); 'On the Colour of the Blood' (1797); 'On Vision' (1811), etc. A selection from his essays and his autobiography were published (1818).

WELLS, wĕlz, England, ancient city and municipal borough, county of Somerset; at the foot of the Mendip Hills; 15 miles southwest of Bath. The cathedral, a remarkably beautiful edifice, begun 704, enlarged 1138, is for the most part in Early English; but its western front, one of the noblest façades in the kingdom, and enriched with 300 statues, is in Gothic. The bishop's palace, founded 1088, is surrounded by a moat supplied from the abundant source of Saint Andrew's Well — from which the town is said to derive its name — and by lofty walls. There are no manufactures, and the trade is chiefly retail. Pop. 4,655.

WELLS COLLEGE, a college for women, located in Aurora, N. Y. It was founded in 1868 by Henry Wells, who at that time deeded to the trustees the main building and 20 acres of land. It is undenominational in its control and policy. In 1888 the main building was destroyed by fire, but immediately rebuilt without crippling the work of the college. A preparatory course was at first maintained, but was abolished in 1896, when the range of elective system was also greatly increased. Formerly the three degrees of A.B., B.L. and B.S. were conferred, but the A.B. degree is now granted for the completion of the course, which is largely elective, especially in the last two years. Biblical literature is among the required studies, courses in the theory and history of music count toward the degree, but technical musical work does not. The discipline is by a system of student self-government, based on a series of simple rules adopted and enforced by the students themselves. The college is situated on Cayuga Lake, and the College Boat Club has erected a boathouse for the use of their members. The college buildings include the main hall, Morgan Hall, a dormitory (the former residence of the founder), a gymnasium, a science hall, and the administration building. The students in 1917 numbered 206, the faculty 34. There are over 30,000 volumes in the library and the productive funds total $521,720. Wells seeks to maintain its distinctive character as a small college, maintaining a high standard of college work, but not attempting university methods.

WELLS AND WELL-SINKING. Wells are excavations for water or other substances such as petroleum, gas or salt; well-sinking is, therefore, the operation by which deep holes of comparatively small diameter are sunk into the earth. Similar holes are drilled in search of coal, iron ore and other minerals, and, although in this case water is not the object in view, yet work of this character may properly be regarded as well-sinking. The process of well-sinking usually implies also the casing of the well either to guard against the choking of the well or to shut out liquids from all strata except that which the well is designed to tap. Wells are variously classified according to the method of sinking, a dug, bored, driven, drilled and jetted; a curb, case or tube wells according to the manner of lining them; as open, shallow or deep; and as artesian, flowing, non-flowing and pumping.

As regards the dug well, the method employed is to excavate it with pick, shovel or drill, shoring the sides with stout planking as the excavation proceeds.

Boring or drilling, however, differs essentially from digging in that all the operations are conducted from the surface, the hole being from 3 to 27 inches or more in diameter. Two distinct methods of well-sinking are commonly included under the terms well-drilling and well-boring, viz., the grinding with pressure, by which a hole is made, and the pounding or shattering of rocks by a heavy chisel-pointed bar. The two methods and the machinery adapted to their application are represented in their highest development on the one hand by the diamond-drill and on the other by the rope-drill or ordinary oil-well apparatus so well known in America. The first cuts or bores a hole either cylindrical or annular, in any desired direction; the other pounds and shatters a hole by its own weight, descending vertically. The pounding or percussion drill is in common use for sinking deep wells either for fresh water, brine, petroleum or gas, while the diamond drill is only occasionally used for this purpose, finding the greatest utility in exploring the harder, inclined rocks for coal,

iron ore, the precious metals, etc. The percussion drill consists of an iron bar tipped with steel drawn to a blunt cutting edge, which is raised repeatedly a few inches and dropped upon a rock, thereby cutting a depression. By slightly turning the bar each time it is raised and causing the chisel edge to strike across the mark left by the preceding blow the depression gradually becomes a nearly circular hole. The hole gradually deepens until the powdered rock prevents further progress. Water is now put into the hole and makes a soft mud of the rock dust, which is now drawn out, and the drilling is resumed. To manipulate long, heavy tools required for a deep well the latter are usually suspended from ropes. More or less complicated machinery is employed but the essential parts of the operation are as described above — raising and letting fall the drill and withdrawing the pulverized rock at regular intervals. The greater number of deep wells are now drilled by steam or gasoline power, while hand and horsepower are used for shallow wells in localities where labor is cheap.

Wells varying from 1,000 to 2,000 feet and over in depth are being drilled in the United States at the rate of about 500 a month. These are mainly in the oil and gas regions of the country, such as Indiana, Ohio and Pennsylvania. The machinery in common use, whether for water or oil, has been developed and brought to its present high degree of perfection in these oil-fields, where certain standard sizes and patterns have been adopted after years of trial. The most prominent object about a deep-drilling well is the derrick or rig, a framework tower 20 feet square at bottom, tapering to four feet at top, and usually 72 to 100 feet high. This tower is for the purpose of carrying two pulleys, the crown pulley in the centre and the block through which the sand-line runs. Over the crown pulley runs the cable by which the drilling tools are suspended and raised or lowered, while the sand-line is a smaller rope and to draw out the sand-pump or bailer, by which the hole is cleaned at short intervals during the drilling. At one side of the rig are the bull-wheels or windlass upon which the cable is wound, and at the other the walking-beam, a heavy timber 20 feet long hung in the centre so that it can oscillate up and down. One end comes directly over the hole, and the other can be attached by a pitman to a crank driven by the band-wheel, which in turn is belted to the engine. This large band-wheel can also be made to run the sand-reel or long windlass carrying the sand-line, one end of the reel being drawn when in use by a powerful lever against the band-wheel.

The band-wheel imparts motion in a third way, by means of an endless bull-rope turning the bull-wheels which wind or unwind the cable. The drilling "set" consists generally of a bit four feet long, weighing 150 pounds; an auger-stem about 40 feet long, and weighing 1,300 pounds; the jars, six feet or more long, weighing 300 pounds; the sinker bar, 16 feet long, weighing 600 pounds; and the rope socket of about 75 pounds on top. The total length of the string of tools is 60 feet, and when suspended from the crown pulley by means of the cable, one and seven-eighths inches in diameter, the tools swing inside the derrick, and when necessary can be stood up out of the way. When in use the tools are lowered into the hole by means of the bull-wheels, then are raised a few inches, and the rope is securely clamped to the temper-screw hanging to the end of the walking-beam, the rope above the point of attachment being allowed to hang freely. By means of the temper-screw the tools can be gradually lowered as drilling progresses, the screw running down five feet. The bit or cutting-tool is faced with steel, has an obtuse cutting edge. The auger-stem is to give weight to the bit and efficiency to the blow. The jars consist of two long, flat links, faced on the inside with steel, playing into each other and permitting a vertical movement of about nine inches. They divide the string of tools into two parts, acting in a degree independently of each other. Above the jars is the sinker-bar, whose purpose is to give efficiency to the upward blow of the upper half of the jars. The jars are used mainly to loosen the tools if the lower part becomes wedged or stuck in the hole After drilling has progressed the length of a "screw" — viz., five feet — the tools are hoisted out and water thrown in if the hole is dry. The sand-pump or bailer, a tube 16 feet or more long with a valve in the bottom, is then run in on the end of the sand-line, and when full of mud and water is drawn out and emptied, the operation being repeated until the hole is free from mud. Then a new bit, sharpened and of full width, is put on the end of the tools, they are run in, and drilling proceeds as before. In some localities drilling is done by means of wooden rods instead of a rope. Where the rocks are soft or unconsolidated it is necessary that the well be lined with casing. This not only keeps the walls from falling in, but also, if properly set, keeps out surface or other waters. It is usual to drill the hole as rapidly as possible, and then slip the casing in, its diameter being less than that of the drill. Sometimes this cannot be done on account of the instability of the walls, and then it is necessary to adopt some modification, as, for instance, drilling ahead a short distance, and then driving the casing down. The latter is usually of wrought iron, put together by means of screw-joints and collars, and capable of standing a pressure of from 1,000 to 3,000 pounds per square inch. In regard to the cost of boring wells, it is safe to assume that wells of 1,000 feet and under cost about $6 per foot; wells from 1,000 to 1,500 feet are relatively cheaper, being about from $4 to $5 per foot; and very deep wells are again relatively expensive because of the special machinery involved and cost over $6 per foot. An essential part of well-sinking equipment are several devices or "fishing tools" to be used in case a rope breaks or the drill becomes wedged in the hole.

Shallow wells are sometimes driven by hammer blows and are known as driven or tubular wells. The tube so driven usually has a pointed end with perforation on the sides of the lower sections.

Well sinking has been carried on from prehistoric times but it was not until the 19th century that improved methods and equipment made possible the boring of deep wells. In 1834–41 a well was sunk at Grenelle, near Paris, to a depth of 1,798 feet; not until 1850 at Kis-

singen, Bavaria, was this exceeded, when a salt spring was tapped at 1,878 feet. In 1855–57 a well 1,923 feet was sunk at Passy, near Paris.

The greatest depth reached by human agency is 7,579 feet in the Lake well, completed in 1919, at a point about eight miles southeast of Fairmont, W. Va. Its mouth is about 1,300 feet above sea-level and it was bored in an unsuccessful attempt to reach certain sands in which gas and oil were expected. The next deepest is a well 7,386 feet deep on the Goff farm eight miles northeast of Clarksburg in northern West Virginia. The third deepest is a well at Czuchow, Germany, which is 7,348 feet deep. The fourth in order is the Geary well 20 miles southwest of Pittsburgh, Pa., 7,248 feet deep. The following are more than 5,000 feet deep.

	Feet
Paruschowitz, Upper Silesia, Germany	6,572
Schladenbach, near Leipsig, Germany	5,735
Springs, 25 miles east of Johannesburg, Africa	5,582
West Elizabeth, 12 miles south of Pittsburgh, Pa.	5,575
Doornkloof, Transvaal	5,560
Aleppo Township, southern Greene County, Pa	5,322
Jacksonville, Fla.	5,000

There are many from 3,000 to 5,000 feet deep. The deepest mine in the world is shaft three of the Tamarack Copper Mine, Houghton, Mich., 5,200 feet, and other copper mines in Lake Superior region are from 4,000 to 5,000 feet deep. Consult Isler, C., 'Well-Boring for Water, Brine and Oil' (2d ed., revised and enlarged, London 1911).

WELLSBORO, wĕlz'bŭr-ō, Pa., borough, county-seat of Tioga County, on the Fall Brook Railroad (New York Central Railroad, about 35 miles north of Williamsport. It is in an agricultural and coal mining region. It has large chemical works, wagon and carriage factories, marble works, lumber mills, tanneries, cut glass works and machine shops. There are two banks and three newspapers. Pop. 3,183.

WELLSBURG, W. Va., city, county-seat of Brooke County, on the Ohio River, and on the Pittsburgh, Cincinnati, Chicago and Saint Louis Railroad, about 15 miles north of Wheeling. It is in an agricultural and sheep-raising region, and in the vicinity are numerous coal mines and natural gas. It has a fine city-hall, paper mills, glass factories, a sack factory, grist mill, sheet metal works and machine shop. There are three banks, a daily and two weekly newspapers. The town was founded in 1790. Pop. 4,200.

WELLSTON, Mo., city in Saint Louis County, on the Missouri River, and on the western outskirts of Saint Louis. Eden College and the Eden and the McKinley seminaries are located here. There are stockyards, lumber yards and manufactures of electrical goods, steel ranges, tools, wire rope and other articles Pop. 7,312.

WELLSTON, wĕlz'tŏn, Ohio, city in Jackson County, on the Cincinnati, Hamilton and Dayton, the Ohio Southwestern, the Detroit, Toledo and Ironton, the Hocking Valley and the Baltimore and Ohio Southwestern railroads, about 72 miles in direct line southeast of Columbus. It is in an agricultural and coal-mining region and has considerable iron manufacturing. There are 40 factories with annual products of $1,500,000. The chief industrial establishments are foundries, blast furnaces, barrel factory, machine shops, cement works and brick works. The city has a high school, public graded schools and a public library. There are two banks and a daily and two weekly newspapers. The city owns and operates the electric-light plant and the waterworks. The government is vested in a mayor who holds office two years and a city council. The place was settled in 1871 and in 1876 was incorporated. Pop. 6,875.

WELLSVILLE, N. Y., village in Allegany County, on the Genesee River, and on the Erie and the Buffalo and Southern railroads, about 20 miles southwest of Hornellsville. It is in an agricultural and dairy region, and in the vicinity are a number of oil wells. It has foundries, machine shops, creameries, flour mill, tanneries and cigar factories. There are two national banks and a daily and other newspapers. It has a high school, graded elementary schools and a public library. Pop. about 5,000.

WELLSVILLE, Ohio, city in Columbiana County, on the Ohio River, and on the Pittsburgh, Fort Wayne and Chicago Railroad, about 85 miles southwest of Cleveland. It is in an agricultural and coal-mining region, and in the vicinity are valuable deposits of fire clay. The chief manufacturing establishments are machine shops, foundries, iron and steel works, brick and tile works, potteries, nail factory, boiler works and railroad shops. There are 60 factories, whose annual finished products total $2,000,000. There are three banks and a daily newspaper, nine churches, a high school, public and parish schools and a public library. The city owns and operates the waterworks. Pop. about 7,769.

WELSBACH (wĕlz'bäh) LIGHT, an invention of Carl Auer von Welsbach, an Austrian, in 1884. As now used it is the familiar gas mantle hung over a gas jet to increase the illumination. It is based upon the discovery that certain materials become incandescent at a low temperature. The process followed is to saturate a combustible filament in the form of a network with a solution of a salt of a refractory earth, such as zirconium. It is then dried out and burned, the combustible element disappearing and leaving a frame of refractory material, which becomes incandescent at a low temperature.

WELSH, Herbert, American reformer: b. Philadelphia, Pa., 4 Dec. 1851. He was graduated from the University of Pennsylvania in 1871; studied art in Philadelphia and in Paris with Bonnat; and practised as an artist in Philadelphia for several years. Visiting the Sioux reservation, impressed with the belief that the Indians required only a just and consistent treatment by the government and the extension of Christian missions to become civilized, he began a movement to secure to them their rights, which resulted in the organization of the Indian Rights Association in 1882. He became corresponding secretary of this association and has been active in its work, which has been instrumental in securing the passage of a bill providing for the individual ownership of land and the application of the civil service law to the Indian service. He also took a leading part in the reform movement in Pennsylvania State politics in 1890; and in 1895 established a weekly

periodical, *City and State*, published in the interests of good government. He strongly opposed the tendency toward imperialism and severely criticized the government's policy and the evils attending the army's occupation of the Philippines. He has written 'Four Weeks among some of the Sioux Tribes'; 'Civilization among the Sioux Indians'; 'A Visit to the Navajo, Pueblo, and Tualpais Indians'; 'The Other Man's Country' (1900), dealing with the Philippine question.

WELSH, John, American merchant: b. Philadelphia, 9 Nov. 1805; d. there, 10 April 1886. He was educated in his native city, where he became prominent in business and was active in public affairs in many capacities, having large railroad and financial interests. He was a member of the Sinking Fund Commission, president of the Philadelphia Board of Trade, etc., and rendered efficient service in promoting relief measures during the Civil War, especially in connection with the Philadelphia Sanitary Fair, in 1864, of which he was president, and which raised over $1,000,000 for army hospital work. In 1873 he became president of the Board of Finance of the Centennial Exhibition, receiving from the citizens of Philadelphia, at its close, a gold medal and the sum of $50,000, with which he endowed the John Welsh chair of English literature in the University of Pennsylvania. In 1878 he went as Minister to England, but in the following year resigned.

WELSH, Robert E., Canadian Presbyterian clergyman and educator: b. New Cumnock, Scotland, 20 March 1857. He was educated at Glasgow and Edinburgh Universities, was ordained in the Presbyterian ministry in 1880 and went to Japan as a missionary. He was in charge of Saint Paul's, Harrowgate, Yorkshire, in 1882–87, and of Saint George's, Brondesbury, London, in 1887–1904. He was general secretary to the Canadian Bible Society in 1905–07, and since 1907 he has been professor of apologetics and church history at the Montreal Presbyterian College. Author of 'In Relief from Doubt' (1895); 'God's Gentleman' (1898); 'The Challenge to Christian Missions' (1902); 'Man to Man' (1905), etc.

WELSH CALVINISTIC METHODISTS, a designation sometimes given to the Calvinistic Methodists, because Wales is the great seat of the sect. The Calvinistic Methodists are distinguished by their Calvinistic sentiments from the ordinary Wesleyans, who are Arminian. Whitfield is regarded as the father and founder of Calvinistic Methodism. Members of this sect have been active in seeking to bring about the disestablishment of the Anglican Church in Wales. See METHODIST CHURCHES OF THE WORLD; PRESBYTERIANISM.

WELSH LANGUAGE AND LITERATURE. See CELTIC LANGUAGES.

WELWITSCHIA, wĕl-wĭch'ĭ-a, a genus of plants of the family *Gnetaceæ*, containing only one species, *W. mirabilis*. This species is confined to the deserts of Southwest Africa, where it was discovered in 1860 by Friedrich Welwitsch. It has a short and top-shaped stem which never grows much above the surface, but increases in thickness until it may be three feet in diameter, and bears a pair of large opposite leaves. These leaves last throughout the whole lifetime of the plant and become ultimately torn up longitudinally into long strips, which trail on the surface of the ground. Two cotyledons which are like short-lived leaves of much smaller size precede them. The flowers of the plant grow in cones like those of many conifers, the cones being arranged in panicles on the end of the stem between the two leaves. The female cones are much larger than the male ones and in fruit are of a scarlet color.

WEMYSS, weems, **Francis Wemyss-Charteris,** 10th Earl of Wemyss and Baron Elcho, English noble: b. 4 Aug. 1818; d. 30 June 1914. He was educated at Edinburgh Academy, graduated at Christchurch, Oxford, and became (1841–46) member of Parliament for East Gloucestershire, then (1847–83) member for Haddingtonshire, and (1852–55) he was Lord of the Treasury. He was aide-de-camp to the late Queen Victoria.

WEN, an encysted tumor, or sebaceous cyst, varying in size, occurring in different parts of the body, but mostly on the scalp and neck; commonly situated immediately under the skin. The causes of their formation are not understood, but a strongly marked tendency to such swellings exists in particular individuals, leading to the belief in constitutional causes. At its commencement the wen is indolent, and it is often many years before it attains any considerable size. It is enclosed in a sac, its contents being sometimes sebaceous matter, in other cases serum, or a thin fetid brown or black fluid. Sometimes the sac contains cartilaginous or even osseous matter. Frequently the sac, especially when small, may be punctured, and its contents pressed out; but sometimes this gives rise to very severe inflammatory action. Another and safe mode of treatment is to dissect them out with the knife wherever their position will admit of it, care being taken to remove the whole of the cyst.

WEN-CHOW, wŭn'chow', China, a treaty port (since 1887) in the province of Che-kiang, on the estuary of the Ta-kai River, flowing into the China Sea, about 200 miles south by west of Shanghai. Ruined palaces, gates, triumphal arches and an immense wall are among the numerous signs of its vanished greatness, but it is still a comparatively clean town, with broad streets and numerous canals. Among buildings of recent erection are the custom-house and the branch of the Imperial Chinese Post Office. The chief imports are cottons, kerosene, sugar, opium, iron and woolens; the principal exports are tea, umbrellas, timber and oranges. The average annual values of the imports and exports during several recent years were about $1,500,000 and $1,250,000, respectively. The tonnage of shipping is about 40,000 per annum. There is also a considerable junk trade. Pop. 205,000.

WENATCHEE, Wash., city and county-seat of Chelan County, on Columbia River, 98 miles southeast of Seattle, and on the Great Northern Railroad. It is situated in the midst of superb scenery, and the surrounding district, for which it is a shipping centre, is interested in agriculture and fruit raising. Pop. 4,050.

WENATCHI. See SALISHAN INDIANS.

was graduated from the University of Glasgow in 1884, and later studied in Edinburgh and on the Continent. He was in charge of the philosophical department of Queen Margaret College, Glasgow, in 1888–95, and since 1896 has been at the head of that department in the University of Michigan. He has published 'Socrates and Christ' (1889); 'University Extension Movement in Scotland' (1895); 'Contemporary Theology and Theism' (1897); 'Preparation for Christianity in the Ancient World' (1898); 'Kant and His Philosophical Revolution' (1910); 'The Anarchist Ideal' (1913); 'Robert Flint- (1914), etc. He was an associate editor of the 'Dictionary of Philosophy.'

WENLOCK GROUP, a British formation of the Upper Silurian geological series. It includes shales and limestones, and is below the Ludlow group and above the Upper Llandovery group, these three comprising the Upper Silurian groups. The Wenlock formation is about 4,000 feet thick, and the fauna has been classed as consisting of 171 genera and 530 species, but many supposed vegetable remains are almost certainly not such. See SILURIAN.

WENSLEYDALE, wĕnz'lĭ-dāl, **James Parke,** BARON, English jurist: b. Highfield, near Liverpool, 22 March 1782; d. Ampthill Park, Bedfordshire, 25 Feb. 1868. Graduated from Trinity College, Cambridge, in 1803, he was called to the bar at the Inner Temple in 1813, went the northern circuit and became known for his wide knowledge of common law. In 1828 he was made a justice of the Court of King's Bench, in 1834 was transferred to the Court of the Exchequer. Here he remained strongly influential until his resignation in 1856, when he entered the Lords as Baron Wensleydale of Walton (Lancaster). In Parliament he spoke rarely, and chiefly on legal questions. His judgments were highly ranked. Consult Foss, 'The Judges of England' (1848–64), or the abridgment of the same, 'Biographia Juridica' (1870); Manson, 'Builders of Our Law' (1895).

WENTLETRAP, a gastropod mollusk, allied to the turret shells and of the genus *Scalaria,* in which the shell is turreted, spiral and ornamented with elevated rib-like processes, crossing the whorls lengthwise of the shell. In some species the spiral is closed; but in the "true" wentletraps the whorls are open, that is, separated. Of the former, some are found in northern seas, and the latter are all natives of warm seas. They are inhabitants of deep waters, but their shells are cast up in great numbers on sandy coasts. They are carnivorous in habits. The famous precious wentletrap, or royal staircase (*Scalaria pretiosa*), formerly brought prices ranging as high as $250 when purchased for the conchologist's cabinet, but its value in the present day is small. Its shell is about two inches long, and twisted in a wide spiral form, and is generally pale-yellow with white ribs.

WENTWORTH, wĕnt'wĕrth, **Benning,** English governor of New Hampshire: b. Portsmouth, N. H., 24 July 1696; d. there, 14 Oct. 1770. He was graduated at Harvard in 1715, became a merchant at Portsmouth, which town he frequently represented in the provincial assembly, was appointed a king's councillor in 1734, and when in 1741 New Hampshire was made a distinct province he became its governor. He so continued until 1767, when he resigned. He was authorized by the Crown to grant patents of unoccupied land, and in 1749 began making grants on the west side of the Connecticut River, in what is now southern Vermont. These grants were considered by the colonial government of New York as within its domain, and, as Governor Wentworth stoutly maintained for a time his authority, the collision so famous in the history of Vermont respecting the New Hamphshire grants ensued. (See VERMONT, *History*). Governor Wentworth exacted heavy fees for his grants of land, and thus accumulated a large property, and in all of them stipulated for the reservation of a lot for an Episcopal church. The town of Bennington, Vt., was named in honor of him. After his resignation as governor he gave to Dartmouth College 500 acres of land, on which the college buildings were erected. For an account of his second marriage, consult Longfellow's poem 'Lady Wentworth.'

WENTWORTH, Charles Watson. See ROCKINGHAM, 2D MARQUIS OF.

WENTWORTH, George, American mathematician, son of G. A. Wentworth (q.v.): b. 1868. He was graduated at Harvard University in 1888, and from 1894 was his father's assistant in the compilation of text-books. Since his father's death in 1906 he has collaborated with D. E. Smith (q.v.) in preparing the Wentworth-Smith mathematical series.

WENTWORTH, George Albert, American mathematician: b. Wakefield, N. H., 31 July 1835; d. Dover, N. H., 24 May 1906. He was graduated from Harvard in 1858, and in 1858–91 was professor of mathematics at Phillips Exeter Academy. With G. A. Hill he prepared a series of textbooks on algebra, arithmetic, geometry and physics, and he was author of the Wentworth Series of mathematical works comprising about 40 volumes, among which are 'Elements of Geometry' (1878); 'Surveying and Navigation' (1882); 'Higher Algebra' (1891), etc.

WENTWORTH, SIR **John,** English colonial governor of New Hampshire, and afterward of Nova Scotia: b. Portsmouth, N. H., 9 Aug. 1737; d. Halifax, N. S., 8 April 1820. He was a nephew of Benning Wentworth (q.v.). He was graduated at Harvard in 1755, being a classmate of John Adams, became a merchant, and in 1765 was the agent of New Hampshire to present petitions in England. While there he was appointed to succeed Benning Wentworth as governor of New Hampshire. At the same time he was made "surveyor of the king's woods" for all North America. Having landed at Charleston, S. C., in March 1767, he traveled through the colonies, registering in each his commission as surveyor, and arrived at Portsmouth in June. The office of governor was at that time an extremely difficult one by reason of the increasing discontent of the colonists. At the first, Wentworth's administration was very popular. He remonstrated against the taxes imposed by the English government, but sought to maintain the loyalty of the colony, and was successful in pre-

Saxons, the wergild for taking the life of the king was 7,200 shillings; for an eolderman, 2,400 shillings; a king's thegn, 600 and a ceorl, 200. In the Anglo-Saxon period an alderman or colderman was a much more important personage than the alderman of to-day, the aldermen of all England being the first subjects of the realm, and other aldermen being governors of counties. Even kings were called aldermen. The thegn, or thane, was a minor noble, and the ceorl, or churl, a tenant-at-will of the thane, or he might be simply a serf or farm-laborer. As the value of money, measured by its purchasing power, was far greater than to-day, the wergeld for king and alderman and even for thane, must have been prohibitory save for the wealthiest members of the community, or when the state assumed the burden of payment, as in the case of an enemy of high rank killed in war, whose relatives were able to wreak vengeance for his death.

Wergild for a homicide had to be paid to the king and the kindred, and also to the thane, or overlord of the slain man. The relatives were not obliged to accept the price of their kinsman's blood, but might, if they chose, exact life for life. If the relatives were satisfied, however, it was not difficult to make terms with the king and thane. The wergild passed away when Norman succeeded to Anglo-Saxon rule, and while fines continued to be imposed on offenders, there was no escape from the capital penalty for homicide except in trial by combat.

WERNER, vĕr'nĕr, **Abraham Gottlob,** German mineralogist: b. near Bunzlau, 25 Sept. 1750; d. Dresden, 30 June 1817. In 1775 he was appointed inspector and teacher of mineralogy and mining in the Mining Academy at Freiberg, in which position he remained for the rest of his life. He was the first to separate geology from mineralogy, and to place the former on the basis of observation and experience. The geological theory with which his name is connected is that which attributes the phenomena exhibited by the crust of the earth to the action of water, and is known as the Wernerian or Neptunian theory, in contradistinction to the Huttonian or Plutonic. He was nominated counsellor of the mines of Saxony in 1792, and had a great share in the direction of the Academy of Mining, and in the administration of public works. He published 'Kurze Klassification und Beschreibung der Gebirsarten' (1787); 'Neue Theorie über die Entstehung der Gänge' (1771). Consult 'Life' by Frisch (1825).

WERNER, Alfred, Swiss chemist: b. Mulhouse, Alsace, 12 Dec. 1866. He was educated at the Carlsruhe Technical School and the Zürich Polytechnic, and took his Ph.D. at the University of Zürich in 1890. He was assistant to Prof. Georg Lunge at the Zürich Polytechnic in 1889; later was assistant to Berthelot in the Collége de France, and in 1895 he was appointed professor at the University of Zürich, where since 1902 he has been director of the lectures on inorganic chemistry. He was awarded the Nobel Prize in chemistry in 1913. Joint author of 'Ueber die räumliche Anordnung der Atome in stickstoffhaltingen Molekulen' (1891); and author of 'Beiträge Zur Theorie der Affintat und Valenz' (1891; 'Beiträge zur Konstitution anorganischer Verbindungen' (1893); 'Lehrbuch der Stereocheime' (1904); 'Ueber die Konstitution und Konfiguration von Verbindungen hoherer Ordung' (1914), etc.

WERNER, Anton Alexander von, German artist: b. Frankfort-on-the-Oder, 9 May 1843; d. 5 Jan. 1915. He studied at the Berlin Academy at Carlsruhe and later in Paris and Italy. He executed several state commissions after his return from Italy, and was commissioned to accompany the general staff of the Third Army corps in France during the Franco-Prussian War. He became professor at the Berlin Academy in 1875, and director there in 1875. His paintings, particularly those of the Franco-Prussian War, are of considerable historic value. Among his works are 'The Capitulation of Sedan'; 'Meeting of Bismarck and Napoleon III at Donchery'; 'Proclamation of the German Empire at Versailles'; 'The Congress of Berlin,' and several portraits of ex-Emperor William II.

WERNER, Friedrich Ludwig Zacharias, German dramatist: b. Königsberg, 18 Nov. 1768; d. Vienna, 17 Jan. 1823. After attending Kant's lectures in his native town, he became in 1793 chamber secretary in the Prussian service, and in 1805 obtained a government post in Berlin, but two years later he retired from the public service. In 1811 he joined the Roman Catholic Church, and in 1814 was consecrated priest at Aschaffenburg. Taking up his residence in Vienna, he became known as an eloquent preacher and later was appointed head of the chapter of the cathedral of Kaminiec. Werner's dramatic works reveal much of the power and pathos characteristic of Schiller, but overlaid to a constantly increasing extent, as he advanced in years, by mystical and undramatic elements. The chief of them are 'Die Söhne des Thals' (1804); 'Das Kreuz an der Ostsee' (1806); 'Martin Luther oder die Weihe der Kraft' (1807); 'Attila' (1808); 'Wanda' (1810); 'Die Weihe der Unkraft' (1813), a sort of retraction of the earlier play on Luther; 'Kunigunde die Heilige' (1815); 'Der 24 Februar' (1815); 'Die Mutter der Makkabäer' (1820).

WERNERITE, an important rock-forming mineral, occurring in cleavable-granular, indistinctly-fibrous or columnar masses, or often in large, coarse crystals. These are tetragonal prisms terminated by pyramids, and show good prismatic cleavage. The hardness in 5 to 6 and specific gravity about 2.7. The most common colors are white or gray; lilac is also quite abundant; occasionally greenish and brick-red varieties are found. Wernerite is a member of the scapolite group (q.v.) and is intermediate in composition between meionite and marialite, being a silicate of aluminum, calcium and sodium, with chlorine. It usually occurs in crystalline limestone. Among its many localities a few of the most important are Arendal, Norway; Bolton, Mass.; northern New York, Ontario and Quebec. The mineral was named (in 1800) in honor of the distinguished mineralogist, A. G. Werner.

WERNZ, vĕrnz, **Francis Xavier,** Director-General of the Society of Jesus: b. Rottweil, Württemberg, 4 Dec. 1842; d. 19 Aug. 1914. He studied philosophy and theology at several

Jesuit colleges and (1857) became member of the Society of Jesus after receiving holy orders at Feldkirch, and study of canonical law at Ditton-Hall. In 1883 he was made professor and (1904) became principal of the Gregorian University, Rome. He was commissioner for the codification of canonical law, counsel of the Congregation and other church matters. He wrote 'Jus Decretalium ad Usum Prælectionum' (1898–1904; 2d ed. 1905).

WERTENBAKER, Thomas Jefferson, American journalist and educator: b. Charlottesville, Va., 1879. His father was Charles C. Wertenbaker and his mother Frances Leftwich. He was educated at private and public schools, Charlottesville, Va., and at the University of Virginia, receiving the degrees of P.A. and Ph.D. from the latter institution. In 1906–07 Mr. Wertenbaker was telegraph editor of the *Baltimore News*, has taught at the Agricultural and Mechanical College of Texas, the University of Virginia and Princeton University. In 1916 he was married to Miss Sarah Rossetter Marshall of Lexington, Ky. At present he is assistant professor of history and politics at Princeton and editorial writer on the New York *Evening Sun*. He has published 'Patrician and Plebian in Virginia' (1910); and 'Virginia under the Stuarts' (1914).

WERWOLF, wĕr'wŭlf, or **WEREWOLF,** wĕr'-wŭlf, a human being transformed into a wolf, according to a belief which has prevailed in all ages and ignorant and superstitious communities. Herodotus, with great naiveté, tells us that when he was in Scythia he heard of a people which once a year changed themselves into wolves, and then resumed their original shape; "but," adds he, "they cannot make me believe such tales, although they not only tell them, but swear to them." But the lycanthropes of the Middle Ages, or *loups-garous*, as they were called by the French, were sorcerers, who during their wolfhood had a most cannibal appetite for human flesh. The Germans called them *Währwölfe*. Many marvelous stories are told by the writers of the Middle Ages of these wolf-men or *loupsgarous*, and numerous authentic narratives remain of victims committed to the flames for this imaginary crime, often on their own confessions.

It is certain that faith in the power of witches to assume the shape of animals, such as wolves, dogs, cats or horses, existed at a comparatively recent time, and is probably not extinguished yet in Western Europe. In the Balkan States, or part of them, belief in the werwolf flourishes to this day, along with the kindred vampire superstition. An old writer says that "the werewolves are certain sorcerers, who, having anointed their bodies with an ointment which they make by the instinct of the devil, and putting on a certain enchanted girdle, do not only unto the view of others seem as wolves, but to their own thinking have both the shape and nature of wolves, so long as they wear the said girdle; and they do dispose of themselves as very wolves, in worrying and killing, and most of human creatures."

The werwolves were said to have in some instances a special hatred of religion and its devotees, and this, coupled with the charge of devouring human flesh, left no doubt as to the fate of anyone who fell under suspicion of being a werwolf. The superstition itself was doubtless due in part to the brutal and savage aspect of human beings who, owing to melancholia or other forms of insanity, went wild in the woods — an occurrence not infrequent in remote districts in the Middle Ages. It was also in all probability connected with the belief, which was a prominent feature of mythology, in the power of the gods and inferior spirits to enter the bodies of animals, and with the doctrine of transmigration of souls, common alike to the ancient Egyptians, the followers of Pythagoras and the Hindus. See WITCHCRAFT.

WESEL, vā'zĕl, Germany, a town in the Rhine province of Prussia, on the right bank of the Rhine, at the mouth of the River Lippe, 35 miles north by west of Düsseldorf. The Rhine is here crossed by a railway and a pontoon bridge, and the Lippe by a railway and two other bridges. The fortifications were demolished in 1890, except the citadel and four outer forts, one of which, Fort Blücher, is on the left bank of the Rhine. This fort was highly developed early in the present century. The Berlin gate, with statues of Hercules and Minerva, dates from 1722. The principal church was founded in the 12th century, and dates in its present form from 1521. It was restored in 1883–96. The town-hall, with a Gothic façade, was completed in 1390. The other buildings and institutions include the Lower Rhine Museum, formerly a French church; the artillery barracks, formerly a Dominican monastery; a royal gymnasium and other higher educational institutions; two hospitals, an orphanage and the fortress prison. Soap, wire and cement are manufactured, and there are also sugar refineries, brick works, flour and oil mills, steam saw-mills, etc., besides a trade in timber, grain, etc. There is ample harbor and quay accommodation. Wesel can be traced back to the 8th century. It was a member of the Hanseatic League, and adopted the Reformation in 1540. It came into Prussian possession in 1814. Pop. 25,000.

WESER, vā'zĕr (Latin, *Visurgis*), a river of Germany formed by the junction of the Fulda and Werra at Münden, between the provinces of Hanover and Hesse-Nassau. It flows tortuously first northwest, then north-northeast between Westphalia and Brunswick and after a circuitous northwestern course, traverses the town and the territory of Bremen, forms the boundary between Hanover and Oldenburg, at Elsfleth turns almost due north, and falls by a wide mouth, incumbered with sandbanks, into the German Ocean. Its whole course is about 480 miles. It is navigable by barges to some distance up both head-streams, but the practical limit of summer navigation is Hameln. The lower part, from Bremen to Bremerhaven, has been deepened and improved for large vessels.

WESLEY, wĕs'lĭ, **Charles,** English clergyman and hymn-writer, younger brother of John Wesley: b. Epsom, Lincolnshire, 18 Dec. 1707; d. London, 29 March 1788. He was educated at Christ Church, Oxford, and there he began, he says, "to observe the method of study prescribed by the university," adding, "This gained me the harmless nickname of Methodist" — a word at first apparently without religious significance, and meaning one who affected method.

In 1735 he was ordained priest. Charles accompanied his brother to Georgia, where he was not very successful, and having returned to England in 1736, became unlicensed curate of Saint Mary's, Islington, where he remained until 1739. In 1739–56 he was an active itinerant preacher. He differed from his brother on some doctrinal and other points, holding, for example, that perfection must be attained by a gradual process. After residing for some years at Bristol and Bath, he went to London in 1771. He is said to have written more than 1,000 hymns, of which very many came into general use. Consult the biographies by Jackson (1849) and Telford (1866), and Julian, 'Dictionary of Hymnology' (1892).

WESLEY, John, English clergyman, founder of Methodism: b. Epworth, Lincolnshire, 17 June 1703; d. London, 2 March 1791. He was a younger son of the Rev. Samuel Wesley (q.v.), and was educated at Charterhouse, and at Christ Church, Oxford. He took his degree in 1724, was ordained deacon in 1725 and became a Fellow of Lincoln College, in which he was appointed Greek lecturer and moderator. He was of a serious and religious turn of mind, and books which impressed him powerfully were the 'Imitatio Christi' and Taylor's 'Holy Living and Holy Dying.' He took priest's orders in 1728, and about the close of 1729 was called from acting as his father's curate to perform the duties of his fellowship in person. At Oxford he found an association of students of which his brother Charles was a member. It was known by various nicknames, among which were the Holy Club, the Bible Moths, the Sacramentarians and the Methodists. It appears that all the association did at this time to earn these opprobrious epithets was to meet on Sunday evenings to read the Scriptures, and on other evenings to read secular literature. John Wesley joined this society, which gradually became exclusively religious in its object, and highly ascetic in its tone. Its members fasted twice and communicated once a week, visited prisons and the sick, and engaged frequently in prayer, meditation and self-examination. Among the members were Hervey and Whitefield. At the time John Wesley joined it the society numbered very few members, but it gradually increased, though it never became a large body. This induced him to decline his father's living at Epworth, that he might continue to exercise his influence at the university. During his residence at the university he became acquainted with Law, author of the 'Serious Call to the Unconverted,' who exercised much influence over him. In 1735 he accepted an invitation from General Oglethorpe to preach to the colonists of Georgia. He sailed on 10 Dec. with his brother Charles and a considerable body of Moravians. During his visit to the colony he paid his addresses to Sophia Hopkey, niece of the chief magistrate of Savannah, or rather, as the story is told, received her advances with favor, but ultimately declined to marry her. Miss Hopkey married a Mr. Williamson, and Wesley, without assigning a reason, refused to admit her to the communion. Her husband threatened legal proceedings, which were not enforced, but Wesley, on account of this event, left the colony, "shaking the dust from his feet." He reached England 1 Feb. 1738, just as Whitefield, under whose preaching Methodism had made great progress, sailed for Georgia. At this time an important event took place in the inner religious life of Wesley. He was converted, according to his own account, about a quarter to 9 o'clock on the evening of 24 May 1738, at a meeting to which he had gone very unwillingly, while Luther's 'Preface' to the Epistle to the Romans was being read. On 13 June he set out for Germany to visit Herrnhut. He met Count Zinzendorf at Marienborn, spent a fortnight at Herrnhut, and returned to England about the middle of September. Whitefield returned from Georgia soon after and became intimately associated with Wesley. He began open-air preaching near Bristol in the following February and his example was soon followed by Wesley. On 11 Nov. 1739 Wesley first preached at the Foundry, a disused structure, formerly employed by the government for casting brass ordnance. This he enlarged and repaired and until 1778 it remained the Methodist headquarters in London. Somewhat later he founded the "United Society," for week-day meetings. From the beginning of this society the inception of Methodism is generally dated.

In July 1740 Wesley separated from the Moravians on account of doctrinal differences. He soon afterward separated from Whitefield, but without a permanent personal breach. Wesley had now sole control of the religious body which adhered to him and he devoted his entire life without intermission to the work of its organization, in which he showed much practical skill and admirable method. His labors as an itinerant preacher were incessant. He had no permanent residence and never intermitted his journeys on account of the weather. He would ride from 40 to 60 miles in a day, read or wrote during his journeys and often preached four or five times a day. He married in 1750 Mrs. Vazeille, a widow with four children, but his habits of life, which he did not attempt to accommodate to his wife, produced an alienation, and they finally separated. Wesley held strongly to the principle of episcopacy, though not a believer in the apostolic succession; and he never formally separated from the Church of England. His collected works were published by himself in 1771–74 in 32 volumes. But in these only a part of his literary output was included, his publications being of the most miscellaneous character, including grammars, an English dictionary, biographies, manuals of history, logic, medicine, which together brought him in large sums of money. In 1780 he commenced a monthly, the *Arminian Magazine*, which he edited during his life, and which after his death was merged in the *Methodist Magazine*.

Against pre-Revolutionary troubles in America he directed 'A Calm Address to our American Colonies' (1775), 'A Calm Address to the Inhabitants of England' (1777) and 'A Serious Address' (1778). He also wrote many hymns, which are included in the 'Poetical Works of John and Charles Wesley' (1868–72). A John Wesley bicentenary was celebrated in June 1903. Consult the biographies by Hampson (1791); Coke and Moore (1792); Whitehead (1791–93); Moore (1824–25); Southey (1820), with 'Notes' by Coleridge and 'Remarks' by Knox, in 1846;

Watson (1831); Tyerman (1870–71); Rigg (1875); Green (1881); and Overton (1891); Wesley's 'Journals' and 'Correspondence,' parts of which are to be found in the various editions of his collected works, first published under his own editorship in 1771–74; Taylor's 'Wesley and Methodism' (1851); Urlin, 'Wesley's Place in Church History' (1870); a bibliography by Green (1896); Leger, A., 'La Jeunesse de Wesley' (Paris 1910); Eayes, G., 'Letters of John Wesley' (1916) and standard histories of Methodism. See also METHODIST CHURCHES OF THE WORLD.

WESLEY, Samuel, English clergyman and poet: b. Winterborne-Whitchurch, Dorsetshire, 17 Dec. 1662; d. Epworth, Lincolnshire, 25 April 1735. He was the father of Charles, John and Samuel Wesley, Jr. Graduated from Exeter College, Oxford, in 1688, he was ordained priest in 1690, became rector of South Ormsby, Lincolnshire, in that year, and in 1695 of Epworth in the same county. He wrote 'Life of Christ: An Heroic Poem' (1693); 'Eupolis's Hymn to the Creator' (1778); and other works, including the posthumous 'Dissertationes in Librum Jobi' (1735), etc. He is best known by the two hymns to be found in Methodist hymn books, 'Behold the Saviour of Mankind' and 'O, Thou, Who, When I Did Complain.'

WESLEY, Samuel, English hymn-writer, son of the preceding: b. Spitalfields, London, 10 Feb. 1691; d. Tiverton, 6 Nov. 1739. He was head-master of Bundell's grammar school in Tiverton, in 1732–39. He did not embrace Methodism with his brothers, and wrote of it as "a spreading delusion." He was graduated from Christ Church, Oxford, in 1715 and took orders. He is best known by his hymns in the Methodist hymn book. Among the titles of individual volumes by him were 'Poems on Several Occasions' (1736); reprinted in 1808 and 1862; and 'The Christian Poet' (1735). Consult Tyerman, 'Life and Times' (1866).

WESLEYAN FEMALE COLLEGE, Macon, Ga., an institution of higher learning for women, founded in 1836 as the Georgia Female College. It was the world's first chartered college for women. It offers courses leading to the degrees B.A. and B.S. and there are besides a conservatory of music and a sub-collegiate department. It is under Methodist supervision and has about 500 students.

WESLEYAN METHODIST CONNECTION OF AMERICA, known commonly as the Wesleyan Methodist Church. See METHODIST CHURCHES OF THE WORLD.

WESLEYAN METHODISTS. See METHODISM IN AMERICA.

WESLEYAN UNIVERSITY, located at Middletown, Conn., was established in 1831 under the auspices of the Methodist Episcopal Church, being the first educational institution of collegiate grade established by that church in the United States. The institution, however, has no organic relation with that church and its charter provides that it shall be absolutely non-sectarian. The founders of the university were offered the buildings of the American Literary, Scientific, and Military Institute if an endowment of $40,000 were raised; the gift was accepted and its condition complied with. In 1868–78 the university's material resources were largely increased and several new buildings erected; and in 1903–16 several additional buildings were erected and the endowment funds doubled; in 1919–20 a campaign for $3,000,000 for endowment and buildings was launched. Though founded and now maintained as a college for young men, women students were admitted from 1872 to 1912. The curriculum was thoroughly liberalized in 1873 and since that date the range and number of courses have been steadily extended. Thorough revisions of the curriculum were again made in 1907 and 1919. Under the present plan the university offers courses leading to the degrees of B.A., Ph.B. and B.S. In each course requirements for generalization, applying in the first two years, provide that the student shall pursue introductory courses in a considerable range of departments, under specifications varying for the several degrees. For the work of the last two years a concentration requirement prescribes that the student shall select the major portion of his studies in a closely related group of departments in order to acquire a considerable mastery of at least one field of study. Departmental honor work is also provided to encourage still greater thoroughness and to develop the student's initiative. Courses of graduate study are provided leading to the degrees of M.A. and M.S. There are two fellowship and 38 scholarship endowments totaling nearly $250,000, besides the scholarships established by the trustees for the remission of the tuition of students considered worthy of such assistance. The students maintain various intercollegiate athletic teams besides carrying on a system of intramural athletics; the control of athletics being vested in an athletic council on which faculty, undergraduates and alumni are represented. They also maintain a semi-weekly paper, musical, dramatic and departmental clubs. There are a Commons Club and 11 Greek letter fraternities, which have their own houses where many of the students live. The university has a campus of more than 40 acres on high ground at the western edge of the city and overlooking the Connecticut River. The buildings include North College, New Dormitory and two smaller buildings used as dormitories; South College, the administration building, and the only one surviving from the old military academy; Memorial Chapel in honor of the students who gave their lives in the Civil War; Rich Hall, containing the library (113,000 volumes, $107,000 endowment for book purchases); the Van Vleck Observatory, with a 12-inch equatorial telescope, soon to be replaced by an 18-inch one; Scott Laboratory of Physics; Judd Hall, which houses a valuable museum and the other departments of science; Willbur Fisk Hall, with recitation rooms; and the Fayerweather Gymnasium. Plans are being prepared for the erection of a chemistry laboratory in the near future. The productive endowment in 1919 was $2,575,000, and the income was $243,000. In the college year 1919–20 the students numbered 595 and the faculty 52 in addition to the president, William Arnold Shanklin, LL.D.

WESSEL, vĕs'sĕl, Johann (surnamed GANSFORT (Dutch, GOSSEVORT), Dutch theo-

logian: b. Groningen, 1419 or 1420; d. 1489. He passed the latter part of his life in retirement in his native country, part of the time in convents. He was a decided opponent of the scholastic theology and in intimate relations with some of the prominent humanists, as Agricola and Höck, yet in his own views leaned strongly toward mysticism. He regarded Christianity as something entirely spiritual, confined to a man's own heart and God. The Scriptures, according to him, are the living source of all true faith; the Church is based upon a compact; there is a general priesthood of the rational universe; faith is to be reposed only in an orthodox pope and not in every council; sin can be forgiven by none but God; excommunication has only an external influence; indulgences refer only to ecclesiastical penalties; the true satisfaction for sin is a life in God; and purgatory is nothing but the purifying influence of a longing after God. After his death some of his works were burned as heretical; his 'Farrago Rerum Theologicarum' was published with a preface by Luther (1522). The most complete edition of his works is that edited by Lydius (1617). Consult Muusling, 'Commentatio Historica-Theologica de Wesseli' (1831); Ullmann, 'Reformatoren vor der Reformation' (1847).

WESSEX, wĕs'ĕks, England, a former kingdom, from the 6th to the 9th century, one of the most important of the Saxon heptarchy, and that in which the other kingdoms were ultimately merged in the reign of Egbert in 827. Wessex, signifying West Saxons, as an independent unit of the heptarchy, occupied a territory now comprised in Dorset, Wilts and parts of Somerset and Hants. See EGBERT; ENGLAND.

WEST, Andrew Fleming, American philologist: b. Allegheny, Pa., 17 May 1853. He was graduated at Princeton University in 1874 and from 1883 he was professor of Latin there, while in 1901 he became also dean of the graduate school. He served for many years as chairman of the American School for Classical Studies at Rome, Italy; is a member of the National Institute of Arts and Letters; and in 1901 was president of the American Philological Association. He received the degree D.Litt. from Oxford University in 1902. Besides writing numerous articles on university and classical education in educational periodicals he edited Terrence's 'Andria' and 'Heautontimoroumenos' (1888); and 'The Philobiblon of Richard de Bury' (1889); and is author of 'A Life of Alcuin' (1902); 'A Latin Grammar' (1902); 'American Liberal Education' (1907), etc.

WEST, Benjamin, American painter: b. Springfield, Chester County, Pa., 10 Oct. 1738; d. London, 11 March 1820. After some instruction from William Williams, a Philadelphia painter, and having painted 'The Death of Socrates' for a gunsmith, he established himself as a portrait painter at Philadelphia at five guineas per portrait and subsequently followed the same profession in New York. In July 1760 he visited Rome, whence he proceeded to Florence, Bologna, Venice and Parma. Returning to Rome, he painted 'Cimon and Iphigenia' and 'Angelica and Medora.' He was elected member of the academies of Florence, Bologna and Parma, and, visiting England in 1763, was so well patronized that he determined to make it his future residence. He executed a historical painting of 'Agrippina Landing with the Ashes of Germanicus' for Drummond, archbishop of York, who introduced him to George III. The king became his steadfast patron and gave him commissions for many years. In 1772 he was made historical painter to the king, in 1790 surveyor of the royal pictures. He was one of four selected to draw up a plan of the Royal Academy, was one of the original members, and there exhibited his 'Death of General Wolfe' (now in the Grosvenor gallery, London) in 1771. In this canvas West departed from the custom of the artists of the day of giving the characters Greek or Roman costumes. Reynolds, who had endeavored to dissuade him, later said, "I retract my objections. I foresee that this picture will not only become one of the most popular, but will occasion a revolution in art." Woolett's plate after this work had the largest sale of any engraving of modern times. West painted a series of historical works for Windsor and for the chapel a series on the progress of revealed religion, divided into four series, antediluvian, patriarchal, Mosaic and prophetic. On the death of Reynolds in 1792 he was unanimously elected president of the Royal Academy. When George III became insane the order for painting the religious series was abruptly recalled and the pay stopped. West had finished 28 pictures and sketched the entire series. He afterward painted a number of religious and historical pictures on very large canvases. Among them may be noticed 'Christ Healing the Sick' (in the National Gallery), the 'Crucifixion,' the 'Ascension' and 'Death on the Pale Horse' (Pennsylvania Academy). The 'Battle of La Hogue' is among the best of his historical pieces. West's pictures numbered about 400. They are chiefly of heroic size and display much inventive power and great skill in composition. But they are monotonously reddish-brown in coloring, and, despite their facility, lack spirit and imaginative value. His position in early American art has won for him a recognition somewhat in excess of his actual merit. Consult Galt, 'Life and Studies of Benjamin West' (1820); Tuckerman, 'Book of the Artists' (1867), and various dictionaries of art.

WEST, James Harcourt, American publisher and Unitarian clergyman: b. Melrose, Mass., 13 Jan. 1856. He was educated at Tufts Divinity School, was engaged in printing and as a newspaper correspondent in 1873–84, and in 1884–94 was minister in charge of various Unitarian and Congregational societies. He founded the *New Ideal Magazine* in Boston in 1889 and was engaged as a publisher for some years. His writings include 'Holiday Idlesse and Other Poems' (1880); 'Uplifts of Heart and Soul' (1887); 'The Complete Life' (1888); 'Visions of Good — Poems of Freedom' (1892); 'In Love with Love' (1894); 'Life Verses' (1905), etc.

WEST, Oswald, American public official: b. near Guelph, Ontario, Canada, 20 May 1873. He was educated in the public schools and from 1889 to 1900 was clerk and paying teller of the Ladd and Bush Bank of Salem, Ore. In 1900–03

he was paying teller of the First National Bank of Astoria, Ore.; in 1903–07 was State land agent of Oregon and in 1907–10 member of the Oregon Railroad Commission. He was governor of Oregon from 1911 to 1915, resuming his law practice at Portland. In 1918 he was Democratic nominee for the United States Senate, but failed of election.

WEST, Paul, American journalist and playwright: b. Boston, 26 Jan. 1871. He graduated from Peekskill Military Academy in 1888 and soon engaged in literary work. Of his musical comedies 'The White Hen' is perhaps the most popular. He is a prolific writer of songs, short poems, magazine articles and newspaper stories. The files of *Everybody's, Cosmopolitan* and *Munsey's* magazines contain a vast amount from his pen. In 1898 he made a permanent connection with the New York *World*. He wrote 'The Love Waltz,' 'At the Waldorf,' 'Birdland,' 'The Twentieth Century,' 'The Song Shop,' 'Short Letters of a Small Boy,' etc.

WEST, Thomas, Baron Delaware or Delawarr, English colonial governor of Virginia: b. 9 July 1577; d. at sea off the Atlantic Coast of America, 7 June 1618. He was educated at Queen's College, Oxford, in 1597 was returned to Parliament for Lymington, fought in the Low Countries and in Ireland, in 1609 became a member of the council of the Virginia Company and in 1610 was made first governor and captain-general for life. On 10 June he arrived at Jamestown, where he soon restored order and comparative prosperity. He established a post at Riquotau (now Hampton), and built two forts. At the time of his coming want and mismanagement had almost compelled the settlement to disperse. By June 1611 he was again in England, where he printed a very favorable report as 'The Relation of the Right Honorable the Lord De-La-Warre.' In March 1618 he set sail once more for Virginia, but he died on the voyage. Consult Neill, 'The Early Settlement of Virginia' (1878); 'Proceedings of the Virginia Company' (Virginia Hist. Soc., 1888).

WEST (THE) AS A FACTOR IN AMERICAN POLITICS. The great West rather than the Atlantic Coast is the true point of view in American history — in which the controlling influence of the frontier is the strongest factor. The West has been America's greatest problem — the problem of expansion by winning a series of frontiers, the last of which marked the completion of the conquest of the continent. Its opportunity of new lands, its presentation of new lessons and duties, its training in adaptation to new conditions and in the creation of new institutions to serve new needs, and its new optimistic visions and ideals, enabled Americans to achieve a larger conception of American destiny and democracy. It has been a constructive force of the highest significance in the evolution and adaptation of political organs in response to changed environment. In the face of Eastern opposition which feared its influence might control the destiny of the republic, its forest philosophy became the basis of a revised American democracy. James Bryce in his 'American Commonwealth' declared that "the West is the most American part of America."

The earliest influence of the West as a factor in American politics appeared in the "contests" of the interior rural element of the colonies against the older settlements nearer the coast, and later reappeared in each political division in political contests of the back-country frontier against the dominating tidewater regions which long retained a predominant influence in the State governments. Among the early illustrations of frontier influence in Virginia were Bacon's rebellion of 1676 and the later increase of small farmer landholders of the interior in the administration of Governor Spotswood by accessions of immigrants and indented servants, resulting in complaints of the tidewater planters. A later illustration was the War of the Regulation in the back counties of North Carolina in 1771.

Increasing in importance by settlements made in opposition to the king's proclamation line, the western frontier became the rear guard of the Revolution and the advance guard of the republic, influencing the negotiations of 1782–83 which established the western boundary at the Mississippi. A large western territory, whose ownership was a source of both diplomatic and interstate controversy, fortunately (through treaty and subsequent state cessions) became national public domain, the first property of the new nation, constituting a common interest and the first tangible sign of national unity.

At the close of the Revolution the frontier conflicts with the east coast were especially noticeable in western Pennsylvania, western Virginia and in the transmontane territory of North Carolina which after the Revolution demanded independent statehood, appealing to the record of their conquest of the wilderness from savagery to civilization. In Massachusetts the contest was marked in the significant movement known as Shay's Rebellion of 1786 which awakened the apprehension of conservative men in the constitutional convention and resulted in restrictions on suffrage which were removed in time only by the development of the interior regions.

In the new constitution frontier influence appeared in the liberal territorial relations and equality of statehood for western communities whose desire for political autonomy had been expressed in various efforts before Congress obtained full control of western lands claimed by the various tidewater State governments.

Jefferson, born on the frontier region of his day, became the prophet of democracy, and, by a series of legislative measures in Virginia, prepared the way for the larger influence and dominance of the interior class — which, however, was only slowly attained by the slow but steady tide of settlements farther and farther toward the interior.

After the Revolution the advancing frontier of transmontane settlements marked the growth of a new and greater West more influential in the nation's destiny. By 1800 the trans-Appalachian region had become the home of about one-tenth of the population. In the decade before 1800 it exercised an important influence in foreign relations in connection with the foreign plans to acquire control of the Mississippi Valley and the Great Lakes. In the decade and a half after 1800 it became a more powerful influence, notably in the purchase of Louisiana in 1803 and the War of 1812 which insured new areas for advance in three directions.

Under its early vision of manifest destiny it successfully resisted the obstacles which checked or restricted its advance. From its early position on the Ohio Valley, as the flying column of the nation, it served as an entering wedge to the possession of the Mississippi Valley. The acquisition of Louisiana, dictated by frontier needs, marked the downfall of a policy of strict construction and furnished a new area for national legislation. It furnished new opportunities for the rise of younger commonwealths which shook the older ones out of their self-centred life, and for the rise of new problems which broadened the processes of nationalization and greatly influenced questions of politics.

In turning the scale in favor of the War of 1812 the West gave voice to the newer nationality of the newer States. Meantime, the possibilities of its great historic waterway furnished the incentive for Fulton's successful invention of the steamboat.

The steady increase of westward extension and the consequent increase of western ideals, between 1800 and 1820, alarmed the established classes of the East who — already sighting a new problem in the labor populations of its cities which began to assert a determination to share in government — saw in the democratic tendencies, of the newly-created frontier States, contagious influences which were already blowing from the West to liberalize the more conservative constitutions of the East.

In the years following the War of 1812, aided by the revolutionizing effect of steam navigation on transportation, and with its practical backwoods ideal of democracy, the phenomenal rise of the new West was the most significant fact in American history. For the half decade after 1815 it furnished a new State each year, carrying the wedge of settlement up the Missouri to its bend at the junction with Kansas on the edge of the traditional "American desert" where the apex of the frontier lines halted for almost three decades awaiting the advance of the right and left flanks which the apex had so far outdistanced.

Thus, by 1820, the West had nine States whose achievement in the extension of more liberal political ideas in American democracy reacted upon the older and more conservative States of the East, both by example and by actual pressure from loss of population through emigration resulting from the more attractive conditions of political equality in the West.

On its advancing frontier depended largely the growth of nationalism and the evolution of American political institutions. Its economic influences after 1815 made it a nationalizing force in the field of domestic policy, as shown in a series of congressional legislative acts which increased the power of the Federal government. In legislative action and in the economic and social characteristics, it stood in opposition to the sectionalism of the coast. In the problems of internal development and economic legislation, in the period between 1815 and 1860, it held the balance of power and set the course of national progress.

By 1822 it had a congressional voting power which gave to its interests and ideals a powerful if not a controlling voice in national councils, and with its strong nationalistic feeling it had a self-confidence untroubled by any doubts of its capacity to rule. Increasingly reacting upon the older sections, by its competition and attraction for settlers, it gradually became a dominant force upon the economic and political life of the nation. Its rising commerce and demand for eastern manufactures attracted the attention of eastern ports (New York, Philadelphia, Boston and others) which entered a race of competition for control of trade through development of State systems of internal improvements in transportation — a rivalry for access to new tributary spheres of influence whose latest phase appeared in railroad legislation.

The result of its influence was liberal construction of the constitution and a larger nationality. Its nationalizing tendency transformed the democracy of Jefferson into the national republicanism of Monroe and later into a new democracy which marked the triumph of the frontier as an effective force in the nation.

Finally in 1829, it elected to the Presidency its typical Scotch-Irish representative, Andrew Jackson, who had become the hero of the whole West in the War of 1812 and by subsequent Indian fighting, and who especially became the mouthpiece of the Western popular will in his assaults upon the national bank as an engine of aristocracy and in his denunciation of nullification in South Carolina. Although its triumph marked the end of an old era of trained statesmen, and a new era of the Spoils system in politics and of lax financial integrity (illustrated by wild-cat banking), it prepared the way for a broader and better democracy whose first great representative was the pioneer rail-splitter, Abraham Lincoln of the old Northwest.

From 1816 to 1832, under the principle of the American system, it turned the scale in favor of protective tariff bills. Under Jackson its characteristic financial policy was expressed in the opposition to the United States Bank.

Its persistent influence induced Congress to abandon its earlier policy of forbidding settlements by "squatters" on unsurveyed lands and periodically to enact emergency indemnifying pre-emption acts; and, finally, in 1841, it succeeded in securing a general pre-emption law — the forerunner of the later Homestead Act of 1862.

Meantime through experience and struggle the West caught the vision of continental destiny. The call of a farther West stimulated new explorations, resulting in continental trails, new problems of long distance government for Oregon and a new California, and new Indian problems.

In the decade after 1840, its advancing frontier influenced diplomatic relations in regard to Texas, Oregon and California, and bore a close relation to the political contests in regard to slavery.

Fostered by the liberal Federal policy which sold land cheaply for "squatters" homes and gave it freely to aid the construction of roads and canals, it received new impetus from the picturesque and spectacular rush to California which so rapidly grew to Statehood and precipitated new problems in American politics.

In 1848 its political influence aided the Democrat nomination of Cass for the Presidency, and also the nomination of Van Buren by the newly-formed Free Soil party. In 1860 it furnished for the Presidency two candidates — Douglas, whose support was in the border zone, and Lincoln, whose strength was in the north-

ern zone. After 1860 its economic and political power continued to increase.

Although early regarded as the child of the South, the Middle West of the Ohio Valley region, with its commerce gradually diverted by the lakes and by rail to the East, became gradually less dependent upon the South and disappointed the hopes of Calhoun and others who planned too late to control it, politically as well as commercially, by the construction of a railroad from Charleston via Chattanooga to western terminals at Cincinnati and at Mobile.

In the critical issues presented by the War of Secession, it and the Upper Northwest furnished the men and the long trains of provisions which drove back the three successive western lines of Confederate defense, opened the Mississippi, pierced the southern gateway of the Appalachian Valley at Chattanooga and drove back the Confederates to Atlanta. With determination that the control of the Mississippi must belong to only one nation, it was a powerful force in preserving the integrity of the Union against the attacks of the slave-holding aristocracy — as it had been in shaping the development of the nation. Its operations were considerably aided by the attitude of the Appalachian frontier region of retarded development — and especially by the new commonwealth of West Virginia, a child of the war, which by keeping the Baltimore and Ohio Railway open for troop transportation between East and West, was a prominent factor in protecting Washington and in saving the Union.

Increased Western political influence after the war was partly due to the leadership of returned soldiers. Following the victory of the Union against disunion, new calls of the farther West finally resulted in the construction of Pacific railways with Federal aid, in a complete change of Indian policy (by the acts of 1871 re-enforced by the Dawes "Indian Land in Severalty" Act of 1887), and in a Greater West whose territory has been formed into self-governing commonwealths marking the extinction of the last frontier.

Between 1870 and 1890 the importance of the West increased with the disappearance of the wilderness in the rapidly diminishing areas between eastward and westward moving frontiers which finally merged. In the Granger legislation of 1873, a phase of political discontent, looking to the government for relief, the West was sustained by legal decisions which prepared the way for the later Interstate Commerce Commission and subsequent extensions of Federal regulations of interstate commerce. Another important phase of Western influence, having its origin in a period of declining agricultural prices contemporaneous with an increased production of silver mines of the Rockies, expressed itself in the Bland-Allison Silver Law of 1878 and the Sherman Silver Purchase Law of 1890. In the Populist movement, a later phase of discontent especially prominent in States of the later frontier, the West expressed a large faith in the power of the national government to cure various evils by government control or ownership of public utilities, expansion of national currency and government regulation of other economic concerns of life in the interest of the common people.

By 1890 its political influence was increased by a group of six new frontier States (North Dakota, South Dakota, Montana, Washington, Idaho and Wyoming) in proximity to the new railroads of the farther Northwest, and it especially appeared as a factor in the revolutionizing of the Democratic party under W. J. Bryan in the election of 1896. The failure of the Western political revolution was due in large part to the older States of the Middle West which, having become adjusted to conditions, had ceased to be discontented, were no longer political enemies of the East and refused to favor free silver. Later, in 1912, after leading his party to defeat three times, Mr. Bryan, as the champion of western interests, reached the height of his spectacular party leadership in the strategy of the Democrat convention at Baltimore which resulted in the nomination of Woodrow Wilson on a platform acceptable to the West. The West was thus the most potent factor in Wilson's nomination, and four years later it sent him to the White House a second time; California was the pivotal State in that election and while it returned Hiram Johnson, a Progressive Republican, to the Senate, it chose Democratic presidential electors and their votes gave President Wilson a majority in the Electoral College. In 1898, after the extinction of the last continental frontier, the West found for its expansive spirit new expression in the over-seas expansion which marked America's maturity as a world power; and later, with its discontent relieved by a tide of prosperity, it exerted a new national influence illustrated in the political "insurgency" movement and in the subsequent Progressive movement for direct popular government and political control of economic life.

In its latest development the West, in the face of new conditions, was forced to abandon its idea of individualism in favor of co-operation and governmental activity under the powerful arm of national authority — which was regarded as necessary for the construction of expensive irrigation works for utilization of the arid lands, and to protect public resources from absorption by the captains of industry.

In the recent World War, the West, in spite of its earlier indifference and its strongly anti-American and pacifist areas, was awakened by the stirring speeches of Roosevelt and President Wilson, and proved loyal to duty in a great cause.

The frontier West exerted a useful influence in producing in American life a renewal of the principles of free government upon which the republic was founded, in keeping alive the principles of democracy in the midst of great accumulations of wealth, in widening the scope of the national government in meeting popular needs for "public improvements," in determining a liberal public land policy based on the idea of homesteads for a democracy of small landholders, in establishing systems of free education culminating in co-educational State universities and in furnishing a reason for the maintenance of a small defensive force of national troops. It provided the way to the fortunate erection of logical and permanent boundaries of the republic at the borders of the Pacific. After the achievement of continental occupation it continued [illegible] for extension of American[illegible] advocacy of a vigorous foreign [illegible] merchant marine and [illegible] Its latest

influence appears in the recent movements for extension of popular participation in government through direct primaries, initiative and referendum and woman suffrage — movements widely popularized by the sympathetic attitude of President Roosevelt who understood the spirit of the West by a period of residence and by close study of its history and problems.

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WEST ALLIS, Wis., city in Milwaukee County, on the eastern outskirts of Milwaukee, and on the Chicago, Milwaukee and Saint Paul and the Chicago and Northwestern railroads. It is an industrial suburb of Milwaukee and manufactures automobiles, trucks, engines, machinery, steel castings, tools and woodwork. Pop. 6,645.

WEST BAY CITY, Mich. See BAY CITY.

WEST BEND, Wis., city, county-seat of Washington County, on the Milwaukee River, and on the Chicago and Northwestern Railroad, about 35 miles north of Milwaukee. It is in an agricultural and stock-raising region. The chief manufactures are flour, wagons, harnesses, spokes, hubs, aluminum ware and pocket-books. It has grain elevators, machine shops, a foundry and a creamery. There are six churches, public and parish schools and one bank. Pop. about 2,462.

WEST BERWICK, Pa., borough in Columbia County, on the Susquehanna River, a suburb of Berwick, 24 miles from Wilkes-Barre, and on the Delaware, Lackwanna and Western Railroad. There is a car and foundry plant here. Pop. about 5,512.

WEST BLOCTON, Ala., town in Bibb County, 40 miles southwest of Birmingham, on the Louisville and Nashville, the Mobile and Ohio and the Southern railroads. Its principal industries are coal mining and lumbering. It has a savings bank, four public schools and municipal waterworks. The value of its taxable property is $500,000. The receipts and expenses average $6,000 annually. The government is vested in a board of aldermen. Pop. 4,000.

WEST BROMWICH, brŭm'ĭch, England, a manufacturing town in Staffordshire, between Wednesbury and Birmingham. The principal buildings include the town-hall with a massive tower; a number of fine modern churches; several chapels of different denominations; public schools; an institute, art and technical schools, a free library and a hospital. There is a fine public park. West Bromwich has a share in the mining and manufacturing industries of this busy district and has grown largely of late years, carrying on the manufacture of iron goods of various kinds, smelting, brass-founding, etc. It was an important centre of arms manufacture during the World War. Pop. 70,000.

WEST CHESTER, Pa., borough, county-seat of Chester County, on the Wilmington and Baltimore and the Philadelphia railroads, about 27 miles west of Philadelphia. It was originally called Turk's Head, but in 1786 the county was divided and the name was changed to West Chester when it was made the county-seat. The new county was called Delaware, but it retained the old county-seat, Chester. West Chester has a number of manufacturing establishments, among which are carriage factories, creameries, gas engine works, sash and door factories and manufactories of hosiery, umbrella tags and wood products. The principal public buildings are the Chester County Hospital, the county courthouse, prison, theatres, a large convent and the municipal buildings. Marshall square contains a soldiers' monument and a handsome fountain. The educational institutions are a State normal school, Villa Maria Academy, Friends' Select School, The Darlington Seminary, West Chester Business College, a public high school established in 1865, public and parish schools, a public library, a law library and three school libraries. There are eight banks and a daily newspaper. Pop. 14,000.

WEST FARNHAM, Canada. See FARNHAM.

WEST FLORIDA, that part of the English possessions in Florida in 1763 west of the Apalachicola River, bounded on the west by Lake Pontchartrain, the Mississippi and Lake Maurepas and on the north by the 31st parallel of latitude. In 1763 it was made into a separate administration district. The governor had the power of convening general assemblies. Laws were made by the governor with the approval of an advisory council and the general assembly. During the Revolutionary War West Florida sided with the British Crown; in 1780 it was attacked by the Spaniards and by 1782 the British were driven out. By the Treaty of 1783, in which England acknowledged the independence of the United States, Spain was permitted to retain Florida but a secret clause of the treaty made the southern boundary of the United States the 31st parallel instead of the line 32° 28′ as had been fixed in February 1764. Spain refused to evacuate the portion between the two lines and a bitter dispute followed with the United States which nearly resulted in hostilities. Finally Pinckney succeeded in negotiating a treaty by the terms of which the 31st parallel was acknowledged as the boundary of West Florida, while the United States assumed all claims against

Spain by citizens of Georgia for spoliation, etc. A new disagreement with Spain developed in 1803 when the United States claimed that part of West Florida west of the Perdido River as part of the Louisiana Territory which it had just purchased from France. The dispute dragged on until in 1810 the part of West Florida between the Perdido and the Mississippi declared its independence of Spain and became the Republic of West Florida. This mushroom State was seized by the United States and law and order were restored to the distracted region. The part west of Pearl River became part of the Territory of Orleans. In 1812 West Florida was added to Louisiana and the part between the Perdido and Pearl rivers was annexed to the Territory of Mississippi. In 1812 English troops had their base in the Floridas in their operations against the United States. Jackson drove them out in 1814 and took Pensacola. During the Seminole War, Jackson again occupied a part of West Florida. The province was administered by United States officials appointed by Jackson until 1819 when it was returned to Spain. In 1819–21 negotiations for the purchase of Florida were undertaken by the government of the United States. On 17 July 1821 Spain ceded all her claims to the United States and in 1822 the portion of West Florida east of the Perdido was incorporated in the Territory of Florida. Consult Fairbanks, G. R., 'History of Florida' (1871); Fuller, H. B., 'Purchase of Florida' (1906); Green, E. L., 'History of Florida' (1898).

WEST HAMMOND, Ill., city in Cook County, on the Calumet River, a southeastern suburb of Chicago. It has a hospital and a high school and there are glue factories. Pop. 4,948.

WEST HARTFORD, Conn., town in Hartford County, on the southwestern outskirts of Hartford. It has an orphanage, an old people's home, a high school and two parks. The Mount Joseph Seminary is situated here, as is the Saint Augustine Normal School. The public library is a memorial to Noah Webster, who was born here. The town is a shipping centre for the surrounding district, which is interested in tobacco culture, dairying and truck gardening. Pop. 4,808.

WEST HAVEN, Conn., village and former borough in New Haven County, now a part of Orange township; it is situated on Long Island Sound and New Haven Harbor, on the southwestern limits of New Haven and on the New York, New Haven and Hartford Railroad. It is principally a residential town, has a high school, two sanitoria, the county hospital and orphan asylum, an inebriates' home and the Florence Crittenden Home. There are manufactures of automobiles, safes and fertilizers. Pop. 8,543.

WEST HAZLETON, Pa., borough in Luzerne County, a suburb of Hazleton, 22 miles southwest of Wilkes-Barre, on the Pennsylvania Railroad and on the Wilkes-Barre and Hazelton Electric Railroad. Its chief industry is a foundry. There are coal mines in the vicinity. Pop. 4,715.

WEST HOBOKEN, N. J., town in Hudson County, enjoying the distinction of being the largest community under town government in the United States, adjoining Hoboken and Jersey City, about one mile from the Hoboken ferry on the Hudson River. It is on elevated land which rises somewhat abruptly from the land along the river at Hoboken. It is a residence place for workers in New Jersey and New York City, and has considerable local manufacturing, especially silk-mills, embroidery works, rubber and feather works. In 1918 the town had 250 manufacturing establishments, which were capitalized for about $6,000,000, the silk factories alone being capitalized for $4,000,000. The yearly production is estimated as $7,000,000. The principal public buildings are Saint Michael's Monastery (Passionist Fathers) and the Dominican Convent. The educational institutions are a theological school at the monastery for their own members, a high school established in 1897, public elementary schools and two large parish schools. There are prosperous banks and two newspapers. Pop. 38,776.

WEST HOMESTEAD, Pa., borough in Allegheny County, on the south bank of the Monongahela River, a suburb of Homestead, opposite the eastern portion of Pittsburgh and on the Baltimore and Ohio Railroad. There are steel-mills, brickworks and manufactories of machinery, axles and car wheels. Pop. 3,009.

WEST HOUGHTON, hō'tŏn, England, a township in Lancashire, five miles west-southwest of Bolton, with manufactures of silk and cotton and coal-mining.

WEST INDIA ISLANDS or **WEST INDIES**. The archipelago that includes the Great and Lesser Antilles and the Bahamas has a total land area of bout 92,000 square miles — more than twice the size of Pennsylvania; the islands are, however, dispersed far and wide over a region continental in size, which extends from lat. 10° N. to 28° N. and from long. 58° W. beyond 85° W. For the geographical subdivisions of the main groups, see ANTILLES and BAHAMAS; for the geologic relations of some of them to the mainland portions of the Antillean continent, see CENTRAL AMERICA and CARIBBEAN SEA; and for the characteristic features of the Great Antilles see the separate articles CUBA, etc.

To pass from a western to an eastern point in this archipelago, one may be obliged to sail about 2,000 miles; and to pass from its northernmost to its southernmost island one must sail more than 1,500 miles. This wide dispersion is the fact which should be first noted. The next step is to realize fully the disjunctive political conditions, the results of the distribution of the islands among a number of competing nations. Let us now consider the political subdivisions. The British possessions are: The Bahamas, including 20 inhabited and many desert islands; Jamaica, with Turks and Caicos Islands, etc.; Windward Islands, including Grenada (the governor's residence), Saint Lucia, Saint Vincent and the Grenadines; Barbados, east of the Windward Islands; Trinidad and Tobago, near the South American coast; and the Leeward Islands, comprising Antigua

densely populated portions of the world" (for example, Barbados: 1,120 to the square mile). "The diverse configuration produces climatic differences, and each kind of rock weathers into its peculiar soil. . . . Some of these islands, through possibilities of a diversified agriculture and hygienic condition, are adapted to higher civilization, and others, either through sterility or ruggedness of relief, are capable of supporting only inferior races." The total number of inhabitants is approximately 6,000,000.

Volcanic eruptions are fortunately confined to Martinique and Saint Vincent, although we see nearly everywhere in the Lesser Antilles evidences of the activity of mighty volcanic forces in times not vastly remote, geologically speaking — for the submerged Antillean continent is fairly bordered with these much later cones that form the eastern volcanic chain.

The climate is not only very agreeable in the winter months but also decidedly healthful, and in many parts of the archipelago, especially toward the northern part, it deserves such commendation at all seasons. The rainy half-year begins, as a rule, in June and (with an interval of clearing weather about August or September) extends to the end of December. From January to June, then, almost ideal conditions of sunshine and cool breezes prevail in the southern and central islands as well as the northern. The northeast trade-winds are most constant in their ministrations to comfort and health during January, February and March; in August, September and October, on the other hand, there are occasional hurricanes — sometimes of great violence.

History.— The history of the West Indies opens 12 October 1492. The royal standard of Spain was then unfurled on an island known to the natives as Guanahani, but named by Columbus, very gratefully, San Salvador. Sir Henry Blake and others have succeeded in identifying the scene of this first landfall as Watling's, the only West Indian island which in every "minute particular" answers the description (by the discoverer himself) of San Salvador or Guanahani. Greatest periods and events in West Indian history are these and such as these: The period of Elizabethan adventurous seamen whose achievements in these waters helped to immortalize the names of Francis Drake and Walter Raleigh and John Hawkins; the period of the buccaneers and of Henry Morgan; that most important, decisive triumph for British naval and colonial enterprise, Rodney's brilliant success in the engagement with the French fleet under de Grasse in 1782; the period or episode, of Nelson, "who chose his bride in Nevis," writes Aspinall, "and, in the *Victory*, the very ship that now lies peacefully in Portsmouth harbor, pursued Villeneuve to the West Indies and back, a fitting prelude to the battle of Trafalgar"; the period of the manumission of the slaves, which was followed, in the British West Indies, by long years of financial distress bravely met (about 1834–38 to the end of the century); and finally the period characterized by that radical improvement in the conditions of agricultural industries and foreign trade which we observe with satisfaction to-day. The author of "Caribbean Interests of the United States" (see *Bibliography*) says: "With European colonies in the West Indies, the development of our trade relations is hampered by a number of causes. . . . Lack of transportation lines hinders exchange with some of the colonies. The subsidized steamship line between the British West Indian ports and Canada drains off some of their trade in that direction. The preferential tariff in force since 1913 affects our trade adversely. The policy of France, also, is to shape her tariffs in the West Indies to shut out the sending of colonial goods to foreign countries and to insure the home market a monopoly of imports where possible. Banking houses, especially when they have government connections, may be used to make the trade run on national lines. The banks in the French West Indies, it is reported, charge 3 per cent in addition to the regular rate of exchange on all payments made through New York. In some of the colonies branches of commercial houses in the home country are established. They buy only for their principals. Furthermore there is a French reciprocity treaty with Haiti which operates to their advantage. Beside these efforts on the part of other governments or their nationals to promote their foreign commerce, our foreign trade is, of course, affected by our tariff." In causes such as these must be sought the explanation of the circumstance that the commerce of the United States expands less readily in the European dependencies than in the Latin American republics of the West Indies. The increase noted in exports from the United States to the British West Indies during the period 1902–14 was 36 per cent; to the Dutch West Indies 43 per cent; to the French West Indies 23 per cent. The increases in the imports into the United States during the same period were: From the British West Indies 27 per cent; from the Dutch West Indies 147 per cent; from the French West Indies 175 per cent. A fact not to be overlooked in this connection is that the British West Indies are as a reward of perseverance, with courage and enterprise, in the face of adverse circumstances, recovering from the long period of depression to which we have referred. Sir Charles Lucas, head of the West Indian Department of the British Colonial Office, has said that while the 19th century had witnessed their distress the 20th would be the century of their regeneration; and Mr. Asquith has given high authority to the statement that they have grown to be independent of financial assistance from Imperial funds. The financial situation, the natural resources, foreign commerce, etc., of the Greater Antilles are subjects of special studies in the articles CUBA, DOMINICAN REPUBLIC, HAITI, JAMAICA and PORTO RICO.

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WEST INDIA TRADE, 1783–1833. When the United States of America declared and won their independence they lost simultaneously the unrestricted trade with those islands in the Antilles which were under the British flag. The Treaty of 1783 made no provisions for the commerce of this region and in the same year trade into and out of the British West Indies was restricted to British vessels by Orders in Council. In 1814 efforts were made in the United States to secure a part of this trade through a modification of the British restrictions; nothing came of these efforts and in 1818 Congress retaliated by closing American ports to British ships from the West Indies. A few years later, in 1822, the English Parliament modified the restrictions, but placed a differential duty in favor of British products. The policy of retaliation was again resorted to in order to have American goods placed on the same footing as British goods. Smuggling was resorted to and a diplomatic deadlock ensued. In 1830 the retaliatory laws of the United States were repealed and British vessels were thereafter admitted on the same terms as American vessels clearing from the same ports. Britain thereupon granted reciprocal privileges. Consult Moore, J. B., 'American Diplomacy' (1905).

WEST MINNEAPOLIS, Minn., village in Hennepin County, on the southwestern limits of Minneapolis. There are manufactories of sewer pipes, threshing machinery and steel springs. Pop. 3,022.

WEST NEWTON, Pa., borough in Westmoreland County on Youghiogheny River, 30 miles southeast of Pittsburgh on the Pittsburgh and Lake Erie and the Baltimore and Ohio railroads. Its principal industries include the manufacture of boilers and radiators. Pop. 2,880.

WEST NEW YORK, N. J., town in Hudson County, on the Hudson River, north of Weehawken and connected with New York by a ferry to 42d street. It has a water front one mile in length and has docks and grain elevators. It is chiefly an industrial community, and manufactures include pianos, silks, textiles, rubber goods, cottonseed oil, sugar, buttons, braid and other products. Pop. 22,943.

WEST ORANGE, N. J., town in Essex County, 13 miles west of New York and five miles northwest of Newark, on the Erie Railroad. It is built at the base and on the slopes of Orange Mountain, and has fine parks and many beautiful residences. Eagle Rock, with its elevation of 650 feet, affords a splendid view. There are manufactures of phonographs, felt hats, lawn mowers and other articles. The place was organized as a township under the name of Fairmount in 1862, was renamed West Orange in 1863, and was incorporated as a town in 1890. Pop. 13,610.

WEST PARK, Ohio, village in Cuyahoga County, on the outskirts of Cleveland and on the Lake shore and Michigan Southern and the Cleveland, Cincinnati, Chicago and Saint Louis railroads. It is a residential suburb of Cleveland. Pop. 3,179.

WEST PITTSTON, Pa., borough in Luzerne County, on the Susquehanna River, and on the Delaware Lackawanna and Western Railroad, opposite Pittston. Two bridges span the river and connect the borough with the city. It is mainly a residential borough, many of the men who do business in Pittston (q.v.) have their homes in West Pittston. Pop. about 6,848.

WEST PLAINS, Mo., city, county-seat of Howell County, on the Saint Louis and San Francisco Railroad, about 125 miles south of Jefferson City. It is the centre and shipping point of a region where there are farming, fruit-growing and lumbering interests. Large quantities of apples, grapes, dairy and farm and lumber products are freighted from this locality. There are two State banks, one daily and four weekly newspapers. The city has adopted the commission form of government. Pop. 2,914.

WEST POINT, Ga., city in Troup County, on the Chattahoochee River, and on the Atlanta and West Point and the Western of Alabama railroads, about 85 miles southwest of Atlanta. It is in an agricultural region in which cotton is one of the chief products. It has cotton gins, cottonseed-oil mills, cotton factories, an iron foundry and a machine shop. During part of the Civil War it was a supply depot for the Confederate army. Pop. about 1,906.

WEST POINT, Miss., town, county-seat of Clay County, on the Mobile and Ohio, the Southern, and the Illinois Central railroads, about 16 miles northwest of Columbus. It was founded in 1857 and is in an agricultural region in which cotton is one of the principal products. The chief industrial establishments are wagon and carriage factories, foundries, machine shops, brick and tile works, lumber mills, sash, door and blind factories, milling and ginning establishment and ice factories. It has six churches, the Southern Female College, Carnegie Library and elementary schools. There is a national bank and a daily newspaper. Pop. about 4,864.

WEST POINT, Neb., town, county-seat of Cuming County, on the Elkhorn River, and on the Fremont, Elkhorn and Missouri Valley Railroad, about 36 miles northwest of Fremont and 80 miles northwest of Omaha. It is in an agricultural region, in which the chief products are wheat and corn. It has a flour mill, creamery, grain elevator, carriage and furniture factories, stock-yards, and coal and lumber yards. There are three banks and two newspapers, besides a high school, graded schools and a school library. Pop. 2,000.

the land sloping to the eastward as the Potomac Valley region. The Ohio Valley region extends from the northernmost point of the State southwestward along its western border to the mouth of the Big Sandy. With but a few exceptional points, the general level of this region runs from 500 feet at the mouth of the Big Sandy, to 1,000 feet at Dingess in Mingo County and at Grafton in Taylor County. The total area of this fertile, well-cultivated agricultural section is 8,326 square miles, or 5,327,640 acres. In it lie the largest cities of the State; Huntington, at an elevation of 538 feet, Charleston, 603 feet, Parkersburg, 624 feet, Wheeling, 647 feet, Morgantown, 822 feet and Fairmont, 842 feet, all elevations at railroad level. This region embraces about one-third of the area and more than one-half of the population of the State.

The Cumberland Plateau, with a general elevation from 1,000 to 2,000 feet, parallels the Ohio Valley region, stretching southwestward from the Pennsylvania line to the upper waters of the Big Sandy and the Tug. It crosses the State as a broad belt from 40 to 60 miles in width, rising in swift elevation to meet and merge into the Allegheny Highlands. The rivers of this section, with a fall varying from 12 feet to 25 feet per mile, rush with corresponding velocity and furnish admirable water power. The area of this section is 6,700 square miles or 4,290,000 acres. Within it are found many of the smaller cities and prosperous towns of the State,—Clarksburg at an elevation of 1,008 feet; Weston, 1,017 feet; Buckhannon, 1,401 feet; Welch, 1,297 feet; Hinton, 1,378 feet, and Elkins, 1,920 feet. This section nurtures and maintains about one-fourth of the State's population.

The Allegheny Highlands takes its name from the predominating mountain range. The general topography is marked by the long, regular, symmetrically-paralleled folds of the Allegheny mountain system. Mountain rolls beyond mountain till the lofty Allegheny crest rises as a barrier wall between the two Virginias. Various parallel and outlying extensions serve to broaden this mountain section which covers, at an altitude ranging from 2,000 to 4,000 feet, nine counties of the State and reaches partly across seven more. The highest peak in the State is Spruce Knob, in Pendleton County, 4,860 feet. Other points of high elevation in this section are High Knob, 4,710 feet and Sharp Knob, 4,545 feet, with more than 20 other peaks exceeding 4,000 feet. **Richwood**, Nicholas County, 2,189 feet; **Coaldale**, McDowell County, 2,336 feet; Terra Alta, Preston County, 2,549 feet; Horton, Randolph County, 2,729 feet; Fairfax, Grant County, 3,060 feet, are thriving coal and lumber towns of high altitude.

The Potomac region consists of the five counties lying east of the Allegheny Mountains and gradually sloping to the lowest point in the State, 286 feet, at Harper's Ferry. The area of this section is 1,780 square miles, or 1,139,200 acres, and the population closely approximates 100,000 people. Broad bottom lands border the rivers and creeks of this section. The lower Shenandoah Valley extends through Berkeley and Jefferson counties, rich alluvial soil and highly cultivated. The agricultural life of the State reaches its highest development in this section.

River System.— The drainage of West Virginia is accomplished by two river systems each entirely distinct from the other. From the culminating apex of the Alleghenies at the junction of Pendleton, Pocahontas and Randolph counties, the eastern drainage is through the Potomac into Chesapeake Bay and the Atlantic Ocean. The western drainage, by far the greater, crosses the State in six river basins, tributary to and forming part of the Ohio system and finally, through the Mississippi and the Gulf of Mexico, likewise mingles with the waters of the Atlantic. The drainage areas are as follows: on the east, the Potomac and its tributaries 3,500 square miles; on the west, the Monongahela and its tributaries 4,300 square miles; the Little Kanawha and its tributaries 2,200 square miles; the Great Kanawha and its tributaries 8,800 square miles; the Guyandotte and its tributaries 1,800 square miles; the Twelve Pole and its tributaries 500 square miles; the Big Sandy and Tug and their tributaries 2,300 square miles. The Ohio is navigable for its entire length up to Pittsburgh. From thence the Monongahela is dammed for slack water navigation as high up as Fairmont. The Great Kanawha is navigable for 90 miles, as far up as Montgomery. West Virginia enjoys thorough irrigation and complete drainage. Not a single square mile is without proper irrigation yet not a single square mile of stagnant water is to be found.

Climate and Rainfall.— West Virginia has a continental climate with the usual variations arising from an extent covering 3½° of latitude and 4,500 feet of altitude. The mean annual temperature at Wheeling in the northern part is 51.64°; at Charleston in the southern part, 54.27°; of the State, 52.30°. Between the last damaging frost in spring, 10–20 April, and the first killing frost of autumn, 10–20 October, there is, every season, ample time to mature fully crops of every variety. The average annual precipitation, including melted snow, is 45 inches. Southwest winds prevail in West Virginia, though somewhat broken up and deflected by the rugged contour.

Geology, Mineral Resources and Mining.— That portion of the earth's crust which is in evidence in the northern and eastern part is made up chiefly of limestone and sandstone. Three well-known and easily-recognized limestones are found here,—the Shenandoah or Trenton; the Lewiston or Helderberg and the Mountain or Greenbrier limestone. Three sandstones exist in like profusion,—the indestructible Medina, the more friable Monterey or Oriskany and the Hamilton shale. Preceding the carboniferous measure is the Great Conglomerate or Millstone Grit, extending across the centre, while the remaining western two-thirds of the State is formed principally of coal measures made up of alternating layers of shales, sandstones, fire clays and coal seams. Some peat is found in the cold and densely-shaded uplands of the Allegheny Highlands.

West Virginia has no deposits of the more valuable metallic ores, though rich in the common minerals. Her most important mineral is coal in the production of which she ranks

second only to Pennsylvania. The Appalachian coal field, like an Indian canoe in shape, with one prow in northern Pennsylvania and the other in western Alabama, extends from the north to the southwest throughout West Virginia. Here it reaches its greatest width, about 100 miles and shows its richest deposits of bituminous coal of varying kinds and qualities. In length 150 miles with an average breadth of 65 miles, the approximate area of the State's coal bed is 9,500 square miles or 6,080,000 acres. Within this area are to be found 85 different seams of coal. Of the 55 counties of the State, 49 are underlaid with coal. More numerous seams of greater thickness, aided by favorable topographical conditions, render it possible, at the same rates of labor, to mine coal in West Virginia at less expense and with greater economy than in any other State, without exception. In 1917, 1,000 mines in operation furnished nearly 16.5 per cent of all the coal produced in the United States. The production fields, formerly five in number, have of late years been reclassified into 11 distinct fields. For the fiscal year ending 30 June 1914 — the Department of Mines reports the following production in short tons: Pocahontas, 18,934,335; Fairmont, 13,115,416; New River, 11,384,111; Kanawha, 10,736,285; Logan, 6,209,748; Preston-Barbour, 4,797,676; Mingo, 2,873,503; Elk Garden, 2,316,-275; Panhandle, 2,213,799; Putnam, 621,514; Mason, 138,466; all other mines 336,000, making the total production for 1914, 73,677,058 short tons. Subsequent reports show production for 1915, 74,184,169; 1916, 79,612,298; 1917, 89,353,450 short tons. The total amount of coal stored in the hills of West Virginia is estimated to exceed 160,000,000,000 short tons, which, at the present rate of production, would not be exhausted in 1,800 years; in fact, the entire production of coal credited to this State to 30 June 1917 exceeds but 1,000,000,000 short tons. So far the coal deposits of West Virginia have only been scratched. Owing to the moderate development of manufactures and the large consumption of natural gas — only 8 per cent of the coal produced is used within the State. Prior to 1910, West Virginia showed annually a steadily-increasing production of coke. High tide was reached that year with 4,217,380 tons valued at $7,525,922. The Solvay process of securing the by-products and other methods of conservation have taken the place of the coke oven. There has been a steady diminution in coke production since 1910, the production in 1916 being 1,957,632 tons. Iron ore exists in West Virginia to the extent of 300,000,000 tons or more. The only production to date is at Orebank on the Potomac above Harper's Ferry and that is less than 20,000 tons annually. The chief deposits are in the wild mountain regions, remote from transportation facilities and are at present inaccessible for commercial mining.

No beds of rock salt have yet been reached in the deep borings made, but brines of great salinity have been secured from wells of varying depth throughout the State. These brines of great strength and abundance are readily accessible for the increased production of salt and its by-products. At present, the production is confined to the Great Kanawha Valley just above Charleston and along the Ohio River in Mason County. In the latter region, extending across the river into Meigs County, Ohio, is the greatest bromine manufacturing field in this country producing 70 per cent of the entire output in the United States.

Inexhautible deposits of almost solid limestone unmixed with shales stretch for many miles in length and several in breadth through the east and northeast. This lies in two broad belts. The one follows the Potomac valleys, along both the north and south branches; the other west of the Allegheny crest and parallel to it, extends from the Pennsylvania line in Preston, to the Virginia line in Mercer County. This latter is of Mountain or Greenbrier, the former of Shenandoah limestone. Great quarries, along the Baltimore and Ohio, from Martinsburg east, produce a large amount of lime and limestone of high grade. West Virginia takes second rank in glass sand production, with immense deposits of the finest quality. The main quantities are in Morgan County, near Berkeley Springs. Great quantities of a lower grade are mined also in Preston and Monongalia counties.

West Virginia abounds in mineral springs, sharing with old Virginia that celebrated plaza, known as the "Spring Region." Berkeley Springs, in Morgan County, also known as "The Warm Springs" and "Bath Springs," has been known to civilization since 1747. It is famous for its unceasing supply of water at the rate of 2,000 gallons per minute, at a uniform temperature of 70°. It is owned and controlled by the State to whom it was devised by Lord Fairfax. Of the remaining score or more of health resorts the most famous is Greenbrier White Sulphur Springs, in Greenbrier County, "the Saratoga of the South." The springs of the State present a variety of chemical composition and therapeutic adaptation. They comprise sulphur, chalybeate acidulous or carbonated, saline, aluminated chalybeate and thermal waters.

Oil and Gas.— The latest United States reports show a diminution in production of oil in West Virginia during the five-year period, 1912-16, with an increase of value. In 1912 12,128,962 barrels were marketed at an average price per barrel of $1.643, making a value of $19,927,721. In 1916 8,731,184 barrels were produced, selling at an average price per barrel of $2.51, a value of $21,914,080. Lack of discovery of new pools and the small capacity of new wells sunk has failed to offset the decline in production in the older districts.

Since 1906 West Virginia has ranked first among all the States in the production of gas. The increase in production has been specially rapid of late years. In 1915 it was 244,004,-599,000 cubic feet, in 1916, 299,318,907,000 cubic feet, and in 1917, 305,264,926,000 cubic feet, with a value of $50,000,000. This is probably high tide in gas production, at least for the present decade. War conditions, less drilling and natural decline in productive capacity have already diminished the supply. The year ending June 30, 1918, shows 289,123,513,000 cubic feet. West Virginia contains 30 per cent of all the natural gas land acreage, and 21 per cent of all the productive gas wells in the United States. Forty per cent of all the natural gas produced in the United States is furnished by West Virginia.

The State consumes itself 13.5 per cent of all the natural gas consumed in the United States, 45 per cent of the population depending on gas for lighting, heating and cooking. It is conveyed by pipe lines to the leading cities in the State, and to Cleveland, Ohio, Cincinnati, Ohio, Pittsburgh, Pa., and Baltimore, Md. The approximate investment in gas plants, service connections and gas-using appliances is $137,000,000. In importance the gas business in the State is second only to that of coal.

Agriculture, Horticulture and Stock Raising.— The total value of farm property in West Virginia in 1910 was $314,738,540, of which amount land was represented by $207,075,759; buildings by $57,315,195; implements and machinery by $7,011,513; and livestock by $43,336,073. This total was an increase in 10 years of $110,831,191. The additional increase of the past eight years will place this value (1918) at $400,000,000. The value of the farm products included cereals, $15,997,700; hay and forage, $7,492,747; potatoes, $2,278,638; sweet potatoes, $170,086; tobacco $1,923,180; dairy products, $5,000,138; poultry and eggs, $9,215,289; wool, $839,555; honey and wax, $231,630; and domestic animals sold and slaughtered, $18,456,122. The total land area of the State is 15,374,080 acres. Of this 10,926,442 acres are held in farms, of which 5,521,757 acres are improved. From the northeast corner of the State extending south and southwest to the Big Sandy River the country is mountainous with narrow valleys. There are no transportation soils, all being from disintegration of limestone, sandstone, or mixtures of shales and clays. The soil is generally fertile and does not wash into gullies, and the land is productive to the tops of the mountains. Clay soil is found in some of the higher portions, alluvial soil in the upland valleys, and unproductive sandy soil in the northeast. In the extreme northeastern counties the soil is of rich limestone. West of the mountains the broad flat hills furnish grazing for cattle, while the valleys produce good crops. The surface near the Ohio River is gently rolling and the soil — clay and sand loams — is rich. Farms are now decreasing in size and are more intensively cultivated. The average size is now 103.7 acres with an average value of $3,000. On most of the farms the principal source of income is from stock raising; hay and grain come next in value; in the eastern panhandle, apples grown for commercial use prove a profitable source of income. The crops for 1918 were (United States Bureau of Crop Estimates) corn, 24,911,000 bushels; hay, 1,000,000 tons; wheat, 4,837,000 bushels; buckwheat, 917,000 bushels; potatoes, 5,568,000 bushels; sweet potatoes, 212,000 bushels; tobacco, 10,200,000 pounds; apples, 1,145,000 barrels, an increase of 443,000 barrels over 1917. The leading domestic animals with their values, in 1916, were — horses, $21,340,000; mules, $1,800,000; milch cows, $14,460,000; other cattle, $14,480,000; sheep, $4,178,000; swine, $3,402,000. The largest corn growing counties are Wayne, Kanawha, Jackson and Mason; Jefferson, Berkeley and Mason lead in the production of wheat; Hampshire, Hardy and Morgan in rye; and Preston, in oats and buckwheat. West Virginia offers unusual orchard possibilities and, with improved transportation facilities, there is a corresponding extension and development of fruit industries. In 1910 there were 7,000,000 fruit trees of bearing age and 5,000,000 under bearing age, a total of 12,000,000. A careful estimate this year places this total in excess of 16,000,000. Some of the largest and most profitable apple and peach orchards in the whole country are in West Virginia. The State to-day produces more apples than the entire section of the United States west of the Mississippi. The average output of Berkeley County (500,000 barrels) exceeds the entire crop of either Oregon or Washington, the apple growing States of the Pacific section. Small fruits (berries) are raised in Brooke, Harrison, Ohio and Wood counties; tobacco in Lincoln, Wayne, Putnam and Cabell counties. The average expenditure on each farm for labor is $22, which shows that the West Virginia farmer does most of his own work. The United States Agricultural Experiment Station is located at Morgantown and is conducted by the State University.

Timber and Lumbering.— There are 15,000 square miles of timber lands in the State, about 74 per cent of the total area. The largest hardwood mills in the world are in Pocahontas, McDowell and Randolph counties. High-water mark in production in West Virginia seems to have been reached in 1909, since which time there has been a slight decrease. The cut of the saw mills for this and four succeeding years was 1909, 1,472,942,000; 1910, 1,428,789,000; 1911, 1,387,786,000; 1912, 1,318,732,000; 1913, 1,249,559,000 feet. The saw mills, during this period, probably reached their maximum; 1,524 in operation, of which 83 were band-saw mills. There are large forests of white pine in the upland regions which scarcely have been touched by the lumberman. The densest forests are in the eastern and southern counties. The principal trees of value found in the State are oak, both red and white, and chestnut, hickory, locust, maple, poplar, birch, hemlock, white pine and spruce. With the multiplication of short railroads and the installation of larger mills, the virgin forests are being reduced rapidly and yet lumbering will continue for years a leading industry of the State.

Manufactures.— In 1914 there were in West Virginia 2,749 manufacturing establishments, with capital invested $175,595,011 and production valued at $193,511,782. Seventy-nine thousand three hundred and fifty-three persons were employed earning $51,377,760. West Virginia, with its vast deposits of coal, great oil pools, immeasurable gas supply and innumerable opportunities for hydro-electric power, possesses irestimable advantages for turning raw material into finished products. Present recognition of this fact is giving promise of rapid growth in manufacturing lines. The added advantage of water transportation along the Ohio has had its effect; the 12-river counties furnish over 60 per cent of the manufactures. The leading manufacturing counties, each producing over a million dollars' worth, are Ohio, Marshall, Wood, Kanawha, Cabell, Tucker, McDowell, Berkeley, Fayette, Randolph, Marion, Morgan, Mineral, Jefferson and Grant. By the same report (United States Census of Manu-

factures 1914) the cities of the State (pop. over 10,000) rank in manufacturing as follows:

Wheeling, 201 establishments, with capital $26,857,896, and giving employment to 9,098.
Huntington, 102 establishments, with capital $7,843,648, and employment to 5,079.
Parkersburg, 83 establishments, with capital $5,741,036, and employment to 2,179.
Fairmont, 50 establishments, with capital $5,276,426, and employment to 2,048.
Charleston, 89 establishments, with capital $3,226,595, and employment to 1,333.
Martinsburg, 37 establishments, with capital $2,629,707, and employment to 1,709.
Moundsville, 27 establishments, with capital $2,530,369, and employment to 1,692.
Morgantown, 49 establishments, with capital $2,306,383, and employment to 1,600.
Bluefield, 24 establishments, with capital $1,129,602, and employment to 1,337.
Clarksburg, 43 establishments, with capital $948,306 and employment to 422.

Lumber and timber products still continue the leading industry in the State, giving employment to 17,417 wage-earners, with production valued at $28,994,240. Iron and steel products easily take second place, with 6,823 employed, and production valued at $28,795,938. Glass-making sands and natural gas have given West Virginia fourth place among glass-producing States. Sixty-three establishments employ 8,889 wage-earners and turn out products valued at $14,631,171. Tanneries, in number 18, employing 1,072 men, produce leather to the value of $11,014,540. Railroad shops, in construction and repair of cars, employ 8,437 men and turn out product worth $10,990,193. Other important industries are flour and grist mills with a production of $7,052,814; and brick, tile, pottery and other clay products amounting annually to $6,798,118. From 1899 to 1904 the value of manufactures increased 47.8 per cent; from 1904 to 1909, 63.5 per cent; and from 1909 to 1914, 19.5 per cent. In 1918, the United States government completed two great war industries — a projectile plant at Charleston and a high-explosives plant at Nitro, 16 miles down the Kanawha — at an expenditure of more than $60,000,000. The future status of these immense plants, just beginning production, is left uncertain by the termination of the war.

Railroads.— The railway mileage in West Virginia is approximately 4,000 miles. Three trunk-lines cross the State: The Baltimore and Ohio, in the northern part, from Harper's Ferry to Wheeling with "the Southwestern" branching off at Grafton and crossing the Ohio at Parkersburg, and the Ohio River branch following the river from Wheeling to Kenova. The Baltimore and Ohio with many short branches fairly well covers the western part of the State. The Chesapeake and Ohio, in the southern part, crossing the mountains into the State at White Sulphur Springs, follows the Greenbrier and Kanawha valleys until it strikes the Ohio River at Kenova and crosses the Big Sandy into Kentucky. It has 22 tributary short lines in this State. The Norfolk and Western crosses the Ohio into West Virginia at Kenova and with four branches traverses the Big Sandy valley and southwestern part, leaving the State at Wills, in Mercer County. Other railroads are: The Western Maryland — from Baltimore to Belington — crossing the Potomac River just above Piedmont and running south 101 miles into the State with eight short branches; the Virginian, from Norfolk to the West Virginia coal fields — entering the State at Rock, in Mercer County — connecting with the Norfolk and Western at Matoaka and 80 miles further on, with the Chesapeake and Ohio at Deepwater; the Kanawha and Michigan entering the State at Point Pleasant and following up the Kanawha River to Gauley Bridge; the Coal and Coke, 175 miles from Charleston to Elkins. Numerous other short lines of less importance traverse the State and feed into these larger lines. The great production of coal, coke and lumber is crowding the present facilities for transportation and will doubtless lead to further railroad construction in the near future.

Banks and Banking.— By compliance with certain legal requirements, charters for banks may be obtained from the secretary of state. There must be a capital not less than $25,000 nor more than $500,000. Ten per cent must be paid in before the granting of the charter and 40 per cent before the bank can open. The State commissioner of banking has authority over the State banks which does not, however, extend to the national banks. The condition of the banks, 30 June 1917, was as follows:

	National	State
Number	115	202
Capital	$10,087,000	$13,856,787
Surplus	6,731,000	8,542,042
Loans	68,515,000	89,590,479
Deposits	94,582,000	112,210,611

Finances.— West Virginia is in wholesome financial condition. It would have no debt whatever were it not for the recent decision of the United States Supreme Court that the State must assume its share of the ante-bellum debt of Virginia. With accrued interest to date, West Virginia is debited with $12,393,929. The State has at present in bonds and other securities $2,970,400, of which $936,400 stands to the credit of the school fund and $2,034,000 to the workmen's compensation fund. The current funds are deposited with various banks named as State depositories and draw 3 per cent interest. The receipts for the fiscal year ending 30 June 1917 were $5,071,911.37 and the disbursements $4,034,835.06. The State tax for 1918 is seven cents on $100 and the assessed valuation, including public service corporations, is $1,366,139,828.

Education.—The educational system of West Virginia is rapidly developing in scope and efficiency. In 1916 the total amount disbursed for the State educational system was $7,651,772.28, of which the expenditure for the common schools was $6,438,007, an increase of more than 57 per cent over the expenditure ($4,094,092) in 1910. The enumeration of minors — 6 to 21 — entitled to public school privileges, was 419,890. Of these 313,873 were enrolled, making a per capita expenditure of $20.51. Ten thousand three hundred and twenty-four teachers were employed, 9,867 white and 457 colored in 6,874 buildings. By constitutional enactment separate schools are provided for the negroes. The average term was six and three-fourths months of 20 days, and the average salary for the term $332.41. The total value of public school property was $15,500,531 in 1916 as against $9,331,694 in 1910. The number of high schools was 164 of which

State Capitol at Charleston

attorney-general are obliged to reside at the capitol. All are elected every four years. Each of the above officials report in writing to the governor 10 days before the meeting of the legislature. The governor must have resided in the State five years and must be at least 30 years of age. In case of a vacancy in the governorship within the first three years after election a new election is held. If the remainder of the term is less than one year the president of the senate acts as governor, and after him the speaker of the house is eligible. The salaries paid are as follows: Governor, $5,000; secretary of state, $4,000; superintendent of free schools. $4,000; treasurer, $3,500; auditor, $4,500; the attorney-general, $4,000; and the commissioner of agriculture, $4,000. The auditor is not only comptroller of the currency but is also register of the land office and commissioner of insurance. Other State officials are the tax commissioner, commissioner of banking, commissioner of labor, compensation commissioner, road commissioners (two), chief of department of mines, health commissioner, game and fish warden, State geologist, State historian and archivist, State librarian, fire marshal and adjutant-general.

The public service commission, three members, is a court of the people in all complaints against public utilities. The board of control, three members, has the financial management of all institutions, charitable and educational, receiving State appropriations. The board of education, six members, three from each dominant party, together with the State superintendent as chairman ex-officio, has control of the educational affairs of the university, the normal schools and other State educational institutions.

The election for State officials is held at the time of the Presidental election and the new officials take office 4 March of the next year. The legislature meets biennially in January of the odd-numbered years and may remain in session not more than 45 days. Half of the senators are elected every two years, and all of the members of the house of delegates. There are 30 senators, two from each of 15 senatorial districts, and, by present apportionment, 94 delegates. A senator must be at least 25 years of age, but only voting qualifications are required of a delegate. The pay is $4 per diem and mileage. A simple majority suffices to override the governor's veto; after five days a bill may become a law without his approval. the legislature is prohibited from anything except general legislation. The State is divided into six congressional districts. The judiciary is composed of (1) the Supreme Court of Appeals; (2) Circuit Courts; (3) nine courts of limited jurisdiction; (4) the courts of county commissioners; (5) justices of the peace; (6) City Courts. The Supreme Court is composed of five judges elected for 12 years, and holds its sessions at Charleston. The judges are paid $5,500 and mileage. There are 23 circuit judges for 23 Circuit Courts; they are paid $3,300 and mileage. A Circuit Court is held four times a year in each county. The rapid development of some parts of the State rendered more courts necessary, so the legislature created nine courts of limited jurisdiction with appeal to the Circuit Courts. Each county is divided into from three to 10 magisterial districts, and each district elects one justice of the peace, or two if the population is greater than 1,200. These justices have the usual powers of American justices of the peace, and jurisdiction over civil suits involving $300 or less. The County Court is not a common-law court and not a court of record, but rather an administrative board for county affairs. There are no chancery courts, but the courts of record have equity jurisdiction; in equity cases the trial court may appoint four commissioners in chancery who decide such questions as the court refers to them and upon their decisions and reports the judge bases his decrees. Notaries public and commissioners are appointed by the governor without limit as to number. The unit of local government is the county under the usual elective county officers; county commissioners, sheriff, clerk, tax assessor, surveyor, etc. The township system was adopted in 1863, but did not work satisfactorily, and in 1872 was abolished and the old county system revived.

History and Politics.— Governor Berkeley of Virginia, in 1670, commissioned Maj.-Gen. Abram Wood "for the finding out the ebbing and flowing of the water on the other side of the mountains." The next year Wood sent out Capt. Thomas Batts and four men. They left Appomattox, now Petersburg, Va., 1 Sept. 1761, crossed the Blue Ridge 7 September, the Alleghenies, 10–13 September, and reached the Great Kanawha at "the Falls," 16 September. Governor Spottswood, in 1716, led a party of 30 cavaliers, crossing the mountains at what is now Pendleton County. In commemoration of this expedition and to encourage westward emigration he founded the "Knights of the Golden Horseshoe," with the motto "Sic jurat transcendere montes." In 1725, John Van Meter explored the valley of the South Branch. In 1727, Morgan ap Morgan built the first cabin in what is now Berkeley County. After 1735, the South Branch Valley began to fill up with the overflow from the Shenandoah Valley and from Pennsylvania and Maryland. The settlers were of several nationalities — and the composition of the people of West Virginia has always been different from that of the country east of the mountains. Some of the land in West Virginia was embraced in the "Northern Neck" grant to Lord Fairfax, and his surveyors, in 1746, planted the Fairfax stone at the head of the North Branch of the Potomac to mark the western limits of the grant. The first permanent settlement west of the Alleghenies was made, in 1764, by John and Samuel Pringle, at Turkey Run, now in Upshur County. In 1768, after the expulsion of the French who claimed the territory drained by the Ohio, the Six Nations sold the land to the English, though several other Indian tribes claimed the country. But within historic times no Indians have ever occupied any part of West Virginia. The attempts of the whites to take possession of these Indian lands led to bloody conflicts that lasted until after the Revolution. The West Virginians heartily supported the Revolution and sent troops to help New England and the Middle Colonies. The history of western Virginia before 1861 is a history of controversy with eastern Virginia. Socially, politically and economically the two sections of the State were unlike from the first. Western

Her citizens denounced the action of the State convention in adopting an ordinance of secession and at town and county meetings passed resolutions looking to a separation of the western counties from the rest and the organization of a new State. On 13 May 1861 a delegate convention was held at Wheeling, 26 counties being represented by nearly 400 leading Union men, and an interchange of views resulted in a decision to secede from the State should the ordinance of secession be ratified by the vote of the people to be given on the 23d of May, and a provisional convention was called to meet on 11 June following. The vote cast on 23 May was large and showed a majority against secession in the west. Out of a vote of about 44,000 in 50 counties 40,000 were against the ordinance of secession.

Meanwhile Governor Letcher had called out the militia of West Virginia and ordered officers to protect the Baltimore and Ohio Railroad and guard the frontier of the State against invasion by Ohio and Pennsylvania. The principal officer assigned to this duty was Col. Geo. A. Porterfield, who 4 May was ordered by Gen. R. E. Lee to Grafton to call out the militia and enroll volunteers to protect the railroad and encourage secession sentiment. Five thousand men were thought ample for the purpose, but Porterfield could not raise a 10th of that number and troops had to be sent from the eastern part of the State. General Lee had informed Porterfield that it was not intended to interfere with the peaceful use of the railroad, but Governor Letcher, incensed at the overwhelming Union sentiment and the apathy of the citizens in volunteering, and moved also by the collection of Ohio troops on the border, ordered Porterfield to make a descent on Wheeling, seize and carry away the arms sent there by the national government and arm his men with them, and specially commanded that should troops of Ohio or Pennsylvania endeavor to pass over the railroad, to destroy it and the bridges. To seize Wheeling was impossible with the few men at his disposal, but, convinced that the Ohio troops were on the eve of a movement eastward, Porterfield burned the bridges of the railroad between Farmington and Mannington. This action was immediately followed by the occupation of the railroad and contiguous country by loyal West Virginia, Ohio and Indiana troops, under command of General McClellan, who had been assigned to the command of a military department embracing Ohio, Indiana, Illinois and West Virginia. Upon the advance of these troops from Wheeling and Parkersburg on the 27th, Porterfield abandoned Grafton on the 28th and fell back to Philippi, from which place he was driven on 3 June to Beverly. (See PHILIPPI, ENGAGEMENT AT). General Garnett was sent to relieve Porterfield and took position at Rich Mountain and Laurel Hill. Col. John Pegram's detachment at Rich Mountain was attacked and defeated by McClellan 11 July, many men were taken prisoners and the rest retreated over Cheat Mountain. McClellan pursued through Beverly and Huttonsville, seized the summit of Cheat Mountain and entrenched a part of his command on the main Staunton turnpike leading over the mountain. (See RICH MOUNTAIN, BATTLE OF). Garnett, who was at Laurel Hill, abandoned his position on the night of the 11th and retreated northeast toward the Northwestern turnpike, was overtaken at Carrick's Ford, on Cheat River, on the 13th, was killed and his command, making a rapid retreat, reached the Northwestern turnpike and turning southward arrived at Monterey in a demoralized condition. There are but three routes across the mountains separating West Virginia from the Shenandoah Valley that are practicable for military operations: the Northwestern turnpike on the north; the Staunton and Parkersburg turnpike farther south and the Kanawha turnpike, leading past Gauley Bridge, still farther south. While McClellan was seizing the two first, a column under General Cox was operating on the latter. At the time General Garnett was sent to Rich Mountain, Gen. H. A. Wise was ordered to raise a force for the defense of the Kanawha Valley and Gen. J. B. Floyd was directed to raise a brigade for service in southwestern Virginia. It had been McClellan's intention to conduct his campaign in West Virginia by way of the Kanawha Valley, but the gathering of the Confederates near Beverly determined him to proceed to that region and postpone his Kanawha campaign till northwestern Virginia should be cleared of the enemy. Later it was found that the presence of Wise in the Kanawha Valley menaced his flank and 2 July General Cox, with a brigade, was ordered to cross the Ohio at Gallipolis and conduct a campaign against Wise, and on the 6th he was ordered to march on Charleston and Gauley Bridge. Cox crossed the Ohio, with about 3,000 men, drove in some of Wise's advanced detachments and on 11 July moved up the Great Kanawha River in transports. The river was navigable for small steamers about 70 miles, to a point 10 or 12 miles above Charleston, the only important town of the region which is at the confluence of the Kanawha and Elk rivers. On the evening of the 16th Cox reached the mouth of the Pocotaligo, a large creek which enters the Kanawha from the north, where he heard that some of Wise's forces were in position above the mouth of Scarey Creek on the south side of the Kanawha and about three miles distant. It was necessary to dislodge this force before he could proceed farther. Troops were landed on the south side of the river, on the 17th, and the position was attacked, but Cox's men were repulsed with a loss of 14 killed and 47 wounded. (See SCAREY CREEK, ENGAGEMENT AT). This check delayed Cox until he could get land transportation, which came on the 23d, and the next day he advanced, took Charleston on the 25th, which Wise had hurriedly abandoned, and on the morning of the 29th reached Gauley Bridge, Wise retreating before him and not halting until he reached Greenbrier and the White Sulphur Springs, where he was joined by General Floyd. The whole of West Virginia, with the gateways to the East were now in Union possession, but the Confederates did not let the possession go unchallenged and made efforts to recover the lost ground.

After the defeat and death of General Garnett, Gen. W. W. Loring was ordered to the command of the Confederate forces in northwestern Virginia, and being strongly reinforced began preparations to retake Cheat Mountain. Before these preparations were completed, Gen. R. E. Lee was assigned to the command of all the Confederate forces in West Virginia and

early in August joined Loring at Valley Mountain, where he remained a month, making himself acquainted with the country, bringing up reinforcements and supplies and elaborating a plan of campaign by which he proposed to break through the Alleghanies and recover the country west to the Ohio. His point of attack was the Union position covering Beverly and the road westward. McClellan had been called to Washington, leaving General Rosecrans in command in West Virginia, and Gen. J. J. Reynolds had command of the Union troops holding entrenched positions at Cheat Mountain summit, Elk Water and Huttonsville. Two Confederate columns were sent by the Staunton road against Cheat Summit and one by the Lewisburg and Huntersville road against Elk Water. At the same time another column was ordered to pierce the line between Elk Water and Cheat Summit, a distance of eight miles through a trackless mountain forest, to gain the rear of both positions. The movement began on 11 September, a part of Lee's command succeeded in reaching the rear of the Union troops at the summit, a part attacked by the Staunton road in front and both were repulsed. The column sent against Elk Water appeared before that position but, upon the failure of the other columns, made no attack, and on the 15th all the columns retired to their old positions. Lee was greatly disappointed and deeply mortified at his failure and was under a cloud from which he did not emerge till after he had succeeded to the command of the Army of Northern Virginia, in June 1862. No further effort was made by the Confederates to regain the ground lost in the northwest, nor was a general Union advance attempted, but there were sharp encounters at Camp Bartow and Camp Alleghany (qq.v.), both resulting in Confederate success.

Floyd and Wise, who had united forces near Lewisburg, moved forward in the middle of August to Sewell Mountain and on the 23d Floyd crossed to the north side of Gauley River at Carnifax Ferry to flank Cox at Gauley Bridge and drive him down the Kanawha Valley to the Ohio. He attacked and defeated the Seventh Ohio at Cross Lanes, on the 26th, and on 10 September was attacked by General Rosecrans and that night recrossed the Gauley and retreated to Sewell Mountain. (See CARNIFAX FERRY). After some delay Rosecrans advanced to the top of Big Sewell Mountain, 34 miles from Gauley Bridge and began skirmishing with the Confederates. Lee, with a part of Loring's command, joined Floyd on 29 September and assumed command. The two opposing armies that lay opposite each other upon the crests of Big Sewell, separated by a deep gorge, were about equal in number, but each commander had exaggerated ideas of the strength of the other and it was difficult for either to make an offensive move. Each was looking for weak points in his adversary's position, using extraordinary energy to feed the men and animals, and waiting for the rains to cease and the roads to dry. But the rains did not cease, there was an extraordinary rise in the waters and on the night of 5 October Rosecrans began to fall back and at the end of four days his brigades were in camp between Hawks' Nest and Gauley Bridge. When Lee discovered that Rosecrans had gone he ordered the cavalry to follow; when satisfied that he had gone clear to Gauley Bridge he began repairing the road from Sewell Mountain to Lewisburg and projected a campaign for Floyd down the left bank of New River and then to the mouth of Loop Creek, the head of navigation of the Kanawha, to intercept Rosecrans' communications, while an effort was being made to press him in front. Floyd lost no time in preparing for the movement to drive Rosecrans from Gauley Bridge back to Charleston, probably to the banks of the Ohio. On 10 October he started and after a difficult march over mountain roads, crossed New River at Richmond Ferry and toiled on over the Raleigh, Fayette and Kanawha turnpike, through Fayetteville, and on the 22d camped on Cotton Hill, five miles beyond Fayetteville, in the elbow south of the junction of the New and Gauley rivers. On the next day he wrote the Confederate Secretary of War that with a proper force he could dislodge Rosecrans from Gauley Bridge and drive him back to Clarksburg, with 10,000 additional men he would win the whole Kanawha Valley before the conclusion of the campaign. Meanwhile Lee had informed him that Loring's troops would march back to the Cheat region, and this settled the fact that he would have to measure strength with Cox unaided by any advance on the Lewisburg road. On 1 November he opened on Rosecrans with artillery. Rosecrans planned to capture him, and on the 12th Floyd retreated, narrowly escaping capture. (See GAULEY BRIDGE). The campaign on the Kanawha, as in the Cheat region, was ended. The inclement weather rendered extended movements impracticable and both Union and Confederates found ample employment in getting up supplies, maintaining the roads in condition, providing shelter and guarding against surprise. Scouting was restricted to narrow limits and the results were unimportant. But the campaign had been one of the greatest importance. The whole line of the Alleghanies, from the Pennsylvania border on the north and beyond the Kanawha on the south, was securely guarded against incursions from the east, and westward to the Ohio River, western Virginia was in the hands of the Union government. The political transformation of West Virginia kept pace with the military movements, finally resulting in a new State. Consult 'Official Records' (Vols. II, V); The Century Company's 'Battles and Leaders of the Civil War' (Vol. I); Cox, 'Military Reminiscences of the Civil War' (Vol. I).

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WEST VIRGINIA AND MARYLAND BOUNDARY DISPUTE. The principal dispute was an old one in regard to the meaning of the "first source of the Potomac" which in Lord Baltimore's charter was mentioned as a point from which to determine the boundary of western Maryland. This was marked in 1746 by the Fairfax Stone at the head of Fairfax Run, which was regarded as the head of the North Branch, in accord with a decision in council based upon a careful survey by a boundary commission. Although in 1852 Maryland finally accepted the Fairfax stone as a point marking the meridian of her western boundary, in 1859 she secured a new survey of the meridian line northward which terminated at the Pennsylvania boundary about three-fourths of a mile west of the old line (surveyed in 1788)

thus laying the basis of later controversies with West Virginia in regard to conflicting land claims and jurisdiction in the triangular strip between the two lines — some of which culminated in personal encounters and breaches of the peace which each State treated as a crime within its jurisdiction and attempted to punish.

In the suit begun against West Virginia in 1890, Maryland, besides claiming that the source of the North Branch should be located nearly a mile west of the Fairfax stone, also injected the old claim to the South Branch as the farthest source of the Potomac — a claim which would have divided West Virginia into two non-contiguous parts. The court decided both of these questions in favor of West Virginia on the basis of prescriptive right arising from long-continued possession of people claiming rights on the West Virginia side of the long-recognized line. Maryland also claimed that the rights of Lord Baltimore included the bed of the Potomac to high-water mark of the southern shore. The court, however, decided that, consistent with long-continued exercise of political jurisdiction, the uniform southern boundary of Maryland was at low-water mark on the south bank of the river to the intersection of the north and south line forming the western boundary of Maryland. The survey and marking of the boundary in accord with the court decision was accomplished by a joint commission in 1912.

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WEST VIRGINIA UNIVERSITY, a co-educational State institution located at Morgantown, 100 miles south of Pittsburgh. The university grounds, with a picturesque outlook upon the adjacent Monongahela River, have an attractive natural site equaled by few institutions of learning. The campus contains about 50 acres.

The university originated from the national land grant act of 2 June 1862, and from the subsequent action of the State legislature in accepting and carrying out the provisions of the act. Its location at Morgantown was largely determined by the foundation of an educational institution which had already been laid at Morgantown through an academy first established in 1814 and re-established in 1832. On 30 Jan. 1867, the legislature accepted the property of the old Monongalia Academy and on 7 February passed an act permanently establishing "The Agricultural College of West Virginia" and authorizing the governor to appoint a Board of Visitors which at their first meeting on 3 April 1867 appointed the first president and established "collegiate, scientific and agricultural" departments of instruction. A department of military science was organized soon thereafter. By an act of 4 Dec. 1868, the name of the college was changed to "West Virginia University" and the close corporation "Board of Visitors" to the "board of regents," which in 1895 became bipartisan and rotary. The original college (Arts and Sciences) began in 1867 with five departments which by differentiation and expansion increased to more than 25 by 1907. After the original college, other colleges and schools were established as follows: the College of Law 1878; the College of Engineering, 1887; the College of Agriculture, 1897; the School of Music, 1897; the School of Medicine, 1902. The agricultural experiment station was established in 1888 and is now under the direction of the dean of the College of Agriculture. The division of agricultural extension was organized in 1912.

For many years the growth of the new institution was very slow and uncertain, largely due to old sectional questions, new post-bellum political questions and the lack of a satisfactory system of secondary schools.

Gradually the obstacles to growth were reduced or removed by changing conditions. Industrial progress, stimulating better communication, was a prominent factor in the transformation of the earlier poorly-equipped school into a real college which may now claim university rank. The first remarkable increase in attendance was coincident with the admission of women between 1889 and 1897, after a long struggle against conservative opposition. In the last decade it has had phenomenal growth, greatly aided by the development of better secondary schools, and is worthy of recognition as one of the leading State institutions. A preparatory school which throughout the earlier years was maintained in connection with the university, was abolished in 1912.

In recent years the curriculum and many of the courses have been readjusted to the new needs resulting from rapidly changing conditions of life. Students are admitted either by examination or on certificate (detailed statement of work) from an accredited preparatory school. Entrance requirements are 15 units (four years of high-school work) with liberal provision for electives. The time required for completion of baccalaureate degrees is four years. Ancient language requirements for graduation in the A.B. course were recently abolished. By a combination of academic and professional work a student may earn the regular university degree and the professional degree in six years.

The problem of securing suitable buildings to meet the needs of expansion and more efficient instruction has been a continuous one. There are now eight main buildings, several with annexes, besides several temporary frame buildings, used for classrooms. A modern library building was completed in 1902. The most recent modern building (Oglebay hall) was completed in 1919 for use by the College of Agriculture. A new building for the College of Law was erected in 1919–20. Buildings and grounds and equipment were valued in 1919 at approximately $2,600,000.

Equipment, which in the earlier days was scarce and poor, has recently been provided liberally. Laboratories are equipped for conducting modern scientific work. The general library contains over 60,000 volumes.

The annual income of the university and experiment station from all sources for the year ending July 1919 was approximately $934,000.

A special feature since 1902 is the Summer School which is meeting the needs of many students who cannot attend during the regular semester.

Recently more attention has been given to advanced courses suitable for graduate work. The master's degree may be completed in an additional year (36 weeks) of advanced study

in residence after completion of the baccalaureate degree. The degree of Ph.D. is not conferred, but graduate work applicable toward this degree may be pursued for certification to other institutions which give their larger attention to gradnate instruction. Research is steadily developing in all colleges.

The total number of students in 1911–12 was 479, of which 449 were candidates for degrees. The total enrolment in the year 1918–19 in the colleges and the School of Medicine (and excluding the School of Music and various short courses) was 1,305, of which 1,281 were candidates for degrees (and 379 were women). The total enrolment in the College of Arts and Sciences was 681, of which 314 were women. That of the College of Engineering was 428; of the College of Agriculture 130 (of which 59 were women); of the College of Law 21, and of the School of Medicine 45 (5 women). The enrolment of the Summer School was 631 in 1919.

In 1911–12 the total number of the instructional force (exclusive of assistants, library staff and experimental station staff) was 68, of which 37 were full professors. In 1918–19 it numbered a total of 118 including 47 professors, 16 associate professors, 20 assistant professors and 35 instructors.

In 1909 the financial and business affairs of the university (and of other State educational institutions) was placed under the direction of a State board of control, consisting of three members appointed by the governor. The academic control remained in a bipartisan board of regents, which until 1919 consisted of the State superintendent of free schools (ex-officio) elected by the people, and of four other members appointed by the governor, but which in 1919 was merged into the State board of education consisting of seven members including the State superintendent.

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WEST VIRGINIA AND VIRGINIA DEBT QUESTION, The. The Virginia debt question arose with the formation of West Virginia, and has been a prominent factor or issue in State politics at various times. At the time of its separation from Virginia, the new State in its constitution agreed to assume a just proportion of the public debt of Virginia prior to 1861 "to be ascertained by charging to it all the expenditures within the limits thereof and a just proportion of the ordinary expenses of the State government, since any part of said debt was contracted, and deducting therefrom all moneys paid into the treasury of the commonwealth from the counties included within the said new State, during the same period." As early as 1866, and again in 1870, Virginia appointed commissioners with authority to negotiate for adjustment of the debt. A West Virginia commission failed to act in 1870, because it was not provided with an appropriation for expenses. In 1871, it declined the proposal of Virginia's new policy of arbitration by commissioners not citizens of either State. Acting alone in the examination of documents at Richmond, however, it reported a net credit of $93,360.23 in favor of Virginia — a conclusion which the West Virginia legislature did not accept. In 1873 a new consideration by the West Virginia Senate finance committee, whose chairman (J. M. Bennett) had been auditor of Virginia for eight years, resulted in a report of $525,000 in favor of West Virginia, which became the basis of public opinion in the new State thereafter.

Meantime, by act of 1871, Virginia funded two-thirds of the debt, and for the remaining third gave certificates making her liable only in accordance with future settlement with West Virginia. Later she released herself from all liability for the one-third by certificates of 1879, 1882 and 1892 which were placed upon the market under the name "West Virginia certificates."

After compromising and settling with her creditors and securing release from all liability, she provided in 1894 for the appointment of a commission (of seven members) which in 1895 and 1896 unsuccessfully proposed negotiations with the West Virginia on the basis that Virginia was liable for only two-thirds of the old debt. In 1900, as trustee of the certificate holders, she again proposed adjustment on conditions which West Virginia declined to accept.

Later, Virginia instituted a suit for settlement under supervision and direction of the United States Supreme Court, which, in 1908, appointed a special master of accounts to take evidence for later presentation. The Supreme Court, before which the final arguments were presented in January 1911, promptly rendered a decision tentatively fixing West Virginia's share of the old debt at $7,182,507.48 and leaving the question of interest for later adjustment. West Virginia then created a "Virginia Debt Commission" to reduce the amount, if possible, preparatory to contingent arrangements for payment. On 14 June 1915 the court issued a judgment against West Virginia for $12,393,929.50 including accrued interest, and for 5 per cent interest thereafter until paid.

In June 1916, Virginia asked the Supreme Court for a writ of execution by levy upon public property of West Virginia. This the court denied for the time in order first to give the West Virginia legislature a "reasonable opportunity to provide for the payment of the judgment." In February 1917, Virginia filed application for a writ of mandamus against the legislature of West Virginia to compel the levy of a tax to pay the judgment. The court, although (in April, 1918) it deferred action, indicated that appropriate remedies for enforcement could be found, both in the power of Congress and in the power of the judiciary under existing legislation, in case West Virginia should fail to do her duty. On 1 Jan. 1919, the amount of the debt was $14,562,867.16. Of this amount, West Virginia, by act of 31 March 1919, arranged to pay $1,062,867.16 in cash and the balance by an issue of "listable" 3½ per cent bonds (coupon and registered) payable in 1939 (or earlier). Consult Ambler, C. H., 'Sectionalism in Virginia' (1910); Fast, R. E., and Maxwell, H., 'History and Government of West Virginia' (1908); Callahan, J. M., 'Semi-Centennial History of West Virginia' (1913).

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WEST WIND DRIFT. See CURRENTS, OCEAN.

WESTALL, Richard, English painter: b. 1765; d. London, 4 Dec. 1836. He was apprenticed in London to an engraver on silver in 1779; subsequently studied at the schools of the Royal Academy and began to practice his art in association with Thomas Laurence in Soho Square. Here he became very popular as an illustrator of books and for a single design in water colors sometimes received $400 or $500. He also painted historical subjects. His 'Elijah Restoring the Widow's Son to Life' was purchased for some $2,250 by the directors of the British Institution; but his paintings in oil were not generally salable; his designs and figures are monotonously conventional, although some of his scenes from peasant life are by no means destitute of freshness and charm. One of his last occupations was that of teaching drawing to Princess afterward Queen Victoria of England. His water-color painting, 'Cassandra Prophesying the Fall of Troy,' is in the South Kensington Museum, and his pictures in oil of 'Christ Crowned with Thorns' in All Souls' Church, Langham Place, London.

WESTALL, William, English novelist: b. White Ash, Lancashire, 7 Feb. 1834; d. 9 Sept. 1903. He was educated at the Liverpool High School, engaged in business and in journalism and was foreign correspondent for the London *Times* and *Daily News*, traveling in North and South America and in the West Indies. He has been a prolific writer and among his publications are 'Tales and Traditions of Saxony and Lusatia' (1877); 'In Tropic Seas' (1878); 'Harry Lohengrin' (1879), and 'The Old Factory' (1881); (Red Ryvington' (1882); 'A Queer Race'; 'A Phantom City.'

WESTBORO, Mass., town in Worcester County, on the Boston and Albany Railway, 12 miles east of Worcester, 32 miles west by south of Boston. It contains five churches, a public library with 18,000 volumes, the Westboro Insane Hospital, the Lyman Reform School, a savings bank, a national bank, a weekly newspaper and numerous important manufacturing industries, the chief being those connected with straw and leather goods, boots and shoes and automobiles. Westboro was settled about 1659, and at first known as Chauncey, but in 1717 it was incorporated under its present name. It is the birthplace of Eli Whitney (q.v.), inventor of the cotton gin. Pop. 5,925.

WESTBROOK, Maine, city in Cumberland County, on the Presumpscott River and on branches of the Boston and Maine and the Maine railroads, six miles west of Portland, with which it is connected by electric lines. The river furnishes considerable water power, which is utilized by manufactories, chief of which are silk and cotton mills, paper and flour mills and machine shops. The silk and cotton products are mainly dress goods, cotton warp and seamless bags. The manufacturing interests include some 42 establishments, with over 1,500 employees and an annual production of $3,500,000. The city has eight churches, the Presentation Convent, a high school, public and parish elementary schools, the Walker Memorial Library, a bank and a newspaper. A city government was inaugurated in 1891. Pop. about 8,281.

WESTBURY, Richard Bethell, BARON, English jurist and statesman: b. Bradford-on-Avon, Wiltshire, 30 June 1800; d. London, 20 July 1873. Graduated from Oxford in 1818, he was admitted to the bar at the Middle Temple in 1833, in 1852 became solicitor-general, and in 1856–58 was attorney-general under Lord Palmerston. This post he held a second time, in 1859–61 and in 1861 he became lord high chancellor of Great Britain. As chancellor he did much by his decisions to aid the development of British equity jurisprudence, especially so in joint stock company law, ecclesiastical appeals and patent law.

WESTCOTT, wĕst'kŏt, **Brooke Foss,** English bishop and theologian: b. Birmingham, January 1825; d. Bishop Auckland, 27 July 1901. He was graduated from Trinity College, Cambridge, in 1848, was elected a Fellow of his college in 1849 and in 1851 was ordained in the English Church. He was assistant master at Harrow 1852–69, and here he remained till 1869, when he became a residentiary canon of Peterborough. He became canon of Westminster in 1883 and on the death of his friend, Lightfoot, bishop of Durham, was appointed his successor in 1890, and in this see he remained until his death. He showed a deep interest in the lot of the miners in his diocese, which won him their genuine esteem, and he was very successful in preventing and settling industrial disputes. From 1870 to 1890 he was regius professor of divinity at Cambridge and during his tenure of the office exercised a powerful and abiding influence on undergraduates and scholars. As a scholar and theologian Westcott's position was a very high one. As a textual critic he is best known for his share in the revision of the Greek text of the New Testament, which occupied him and J. F. A. Hort for 28 years, and resulted in the publication of their important work, 'The New Testament in the Original Greek,' in 1881. The text formed the basis of the Revised Version of the New Testament. His other published works include 'General Survey of the History of the Canon of the New Testament During the First Four Centuries' (1855), which has gone through many editions; 'Introduction to the Study of the Gospels' (1860); 'A General View of the History of the English Bible' (1868); 'The Paragraph Psalter' (1879); 'The Revelation of the Risen Lord' (1882); 'Social Aspects of Christianity' (1887); 'Essays in the History of Religious Thought in the West' (1891); 'The Gospel of Life' (1892); 'The Incarnation and Common Life' (1893); 'Lessons of the Revised Version of the New Testament' (1894); 'Christian Aspects of Life' (1895); 'Lessons from Work' (1901), and 'Words of Faith and Hope' (1902). He was one of the New Testament revision company. Consult 'Life,' by his son (1903).

WESTCOTT, Edward Noyes, American novelist: b. Syracuse, N. Y., 27 Sept. 1847; d. there, 31 March 1898. He was a banker in his native city, but compelled to retire because of failing health, spent the winter of 1895–96 in Italy and in the latter year completed the novel

'David Harum,' which he had begun soon after his retirement from business. It was declined by many leading publishers, but when issued in the autumn of 1898, six months after the author's death, became at once a success, reaching a sale of 400,000 copies in a little more than a year. The human nature of the book is its strong characteristic; it is a faithful reflection of certain phases of life in central New York and its humor is undeniable.

WESTERLY, R. I., the largest town in the State south of Providence, in Washington County, on the Pawcatucket River, and on the main branch of the New York, New Haven, and Hartford Railroad. It is in the southwestern part of the State, and near Long Island and Fishers Island sounds. The first white settlers came from Newport, and for a while kept the Indian name, Misquamicut. For a time it was also known as Southernton. On 14 May 1669, it was incorporated under the present name. In 1686 it changed its name to Haversham, and in 1689 it was again renamed, Westerly. The town contains five villages, each with its own post office. The chief manufacturing industries are cotton, wool and silk mills, printing presses and thread. The granite quarries, among the largest in the country, have made the name "Westerly Granite" known the world over. The summer resort Watch Hill, one of the villages of the town, has a summer population of 3,000. Other summer resorts within the town limits are the beaches known as Atlantic Beach and Weekapang. The town has eight churches, a Federal post office and a county courthouse. The public library, "The Wilcox Memorial Library," a heavily endowed institution, is one of the best in New England. There are two banks with deposits of about $6,000,000. Pop. about 10,075. Consult Denison, 'Westerly and Its Witnesses'; Weeden, 'Early Rhode Island' (1910); also various publications of the Westerly Historical Society.

WESTERMARCK, Edward Alexander, Finnish anthropologist: b. Helsingfors, 20 Nov. 1862. He was educated at the Lyceum at Helsingfors, and at the University of Finland. He was appointed professor of moral philosophy at the University of Helsingfors in 1894; was engaged in travel in northern Africa in 1898–1902, studying the moral conditions of the primitive races; and in 1907 was appointed professor of sociology at the University of London. He also lectures frequently at the University of Helsingfors. His book 'The History of Human Marriage' (1891) went through several editions and was translated into French, Italian, Spanish, Swedish, Russian, German and Japanese, and gained for him a world-wide reputation. He is also author of 'The Origin and Development of the Moral Ideas' (2 vols., 1906–08); 'Marriage Ceremonies in Morocco' (1914), etc.

WESTERN AUSTRALIA, one of the States of the new Commonwealth of Australia. See AUSTRALIA, WEST.

WESTERN EMPIRE, The, the western portion of the Roman empire, consisting of Italy, Illyricum, Spain, Gaul, Britain and Africa, as distinguished from the Eastern or Byzantine empire, comprising the eastern half of the Balkan Peninsula, Greece, Egypt, Syria and Asia Minor, so far as Persia. This partition of the Roman empire occurred in 364 when Valentinian I shared the imperial authority with his brother Valens, who ruled in Constantinople as emperor of the East, while Valentinian ruled in Rome as emperor of the West. The partition became final in 395 when Theodosius the Great divided the Roman world between his two sons Honorius, who became emperor of Rome and the West, and Arcadius, who became emperor of Constantinople and the East. The Western empire terminated in 476. See BYZANTINE EMPIRE; ROME.

WESTERN FEDERATION OF MINERS (since December 1916 known as the *International Union of Mine, Mill and Smelter Workers*), a labor organization of persons working in mines, mills and smelters, founded 15 May 1893, at Butte, Mont., and having for its object the general improvement of its members, the abolition of child labor, government by injunction, etc. The executive board is made up of a president, vice-president, secretary-treasurer and four organizers. This board passes on all joint contracts to which local unions are a party, on every strike and acts as a board of arbitration when occasion offers. It directs the federation except during the biennial convention, when the latter is supreme. The Federation resulted from the strike of 1892 at Cœur d'Alene. It was involved in another strike there in 1899, in which the struggle between operators and miners became most bitter. In 1896–98 it was affiliated with the American Federation of Labor, and thereafter to 1905 with the American Labor Union. It helped form the Industrial Workers of the World in 1905, but withdrew in 1906. In 1911 it again joined the American Federation of Labor. The membership is not bound by any political party or platform. The *Miners' Magazine* is the official publication.

WESTERN ISLANDS. See AZORES; HEBRIDES.

WESTERN MARYLAND COLLEGE, located at Westminster, Md. It was founded under the auspices of the Methodist Protestant Church, and was first opened to students in 1867. It was the first college in the South to offer equal educational privileges to both sexes; but it is not strictly co-educational, as there are separate classes for women, though they are taught by the same instructors and have practically the same courses of study as the men. The courses of study are arranged in three groups, which are practically the same in the first two years, but differ in the last two, and in accordance with the predominating study are known as the classical, the scientific and the historical. The degree of A.B. is conferred for the completion of a four years' course in any of these groups. In addition, courses are offered in music, art and elocution, and students who complete one of these courses may substitute it for certain studies of the junior year. There is also a preparatory school which in 1899 was established in a separate building (Levine Hall) a short distance from the campus. There are two State scholarships for each senatorial district. The campus contains 14 acres situated on elevated ground in the western part of the city. The

main building consists of a central part, the original building and five wings: (1) Owings Hall, extending back from the central part; (2) Smith Hall, extending to the east; (3) Hering Hall, extending to the west; (4) Ward Hall, a rear extension of Hering Hall, and (5) a rear extension of Smith Hall. Other buildings are the Yingling Gymnasium, Y. M. C. A. Hall, Baker Chapel, built of white stone, and Alumni Hall, containing a large assembly room, the halls of the literary societies, etc.

WESTERN PORT, Md., town in Alleghany County, on the north branch of the Potomac River, 20 miles southwest of Cumberland, and on the Western Maryland Railroad. It is situated in a coal mining district, and there are paper factories. Pop. 2,702.

WESTERN RESERVE, or **CONNECTICUT RESERVE**, that portion of the Northwest Territory (q.v.) reserved by Connecticut when, in 1786, that State ceded to the United States other parts of the territory claimed under the charter of 1662, which granted to Connecticut lands limited east and west by the sea. This section of land is what is now included in the northeastern part of Ohio; it was all the territory between lat. 41° and 42° 2′ N., and extending 120 miles from the western boundary of Pennsylvania. In 1795–96 Connecticut sold this land, except 500,000 acres, to a number of men who established what was known as the Connecticut Land Company. At first settlers hesitated about purchasing any of the land on the "Reserve," fearing the validity of the title, but when the State of Connecticut yielded all claim to the government, there was no longer any doubt about the titles. There were a large number of colonists from Connecticut who settled on this "Reserve," counties were organized, 13 in all, which were in whole or in part from lands of the "Reserve." (See NORWALK, OHIO). The people were characterized by their thrift, industry and the manner in which they established schools. A large part of the money received by Connecticut for the sale of the lands was set aside "as a perpetual fund, the interest of which should be appropriated to the support of schools." This school fund was the means of influencing in Ohio a unique system of education, in some respects different from that of any other State. Consult Matthews, 'Ohio and Her Western Reserve' (1902).

WESTERN RESERVE UNIVERSITY, located at Cleveland, Ohio, includes the College for Women, the Graduate School, the Medical School, the Law School, the Dental School, the Library School, the School of Pharmacy, the School of Education (summer sessions) and the School of Applied Social Sciences. As a working, though not a corporate, part of Western Reserve University is Adelbert College of Western Reserve University. Adelbert College of Western Reserve University was founded as Western Reserve College in Hudson, 26 miles from Cleveland, in 1826. As the territory formerly belonged to Connecticut, and derived its name from being territory in the West reserved for special purposes, so also the influence of Connecticut's great college dominated in its establishment and during its first decades. In affiliation with the college at Hudson for many years was the Cleveland Medical School. Theological instruction was also given for many years, ceasing in 1853. In 1882 Western Reserve College was moved to Cleveland Amasa Stone (q.v.) gave to the college the sum of $600,000. In recognition of the gift the college took the name of a beloved son of Mr Stone, who died while a student at Yale, becoming Adelbert College of Western Reserve University. Subsequent gifts and bequests, together with gifts made by members of his family, have amounted to more than $1,100,000. In 1884 a university charter was obtained. The following departments, in addition to the Medical School, were established: In 1888 the College for Women, in 1892 the Dental School, the Law School and the Graduate School, in 1903 the Library School, in 1882 the School of Pharmacy, in 1915, the School of Education and the School of Applied Social Sciences. The Library School was endowed by a gift of $100,000 made by Andrew Carnegie.

The college and the university have throughout their history been distinguished by a high type of scholarship. Among the professors have been Rev. Laurens Perseus Hickok, 1836–44; Rev. Clement Long, 1844–52; Nathan Perkins Seymour, 1840–70; Elias Loomis, 1836–44; Charles Augustus Young, 1856–66; Elijah Porter Barrows, 1837–52; Samuel St. John, 1838–52; Samuel Colcord Bartlett, 1846–52. Its presidents have been Charles Backus Storrs, 1830–33; George Edmond Pierce, 1834–55; Lawrence Hitchcock, 1855–71; Carroll Cutler, 1871–86; Hiram Collins Haydn, 1887–90. Charles Franklin Thwing has been president of the university since 1890. The whole number of students in the different departments, from the beginning, has been as follows: Adelbert College, 3,545; The College for Women, 2,500; the Graduate School, 400; the School of Medicine, 5,200; the Law School, 1,800; the Dental School, 700; the Library School, 496; the School of Education (summer sessions) 2,781; the School of Applied Social Sciences, 329 (including students in extension courses). The buildings and equipment are valued at almost $4,000,000 and the entire property $8,000,000.

In the fall of 1918, there was begun the erection of a new Gymnasium Armory. This building is 175 feet in length by 90 feet in width.

In the general educational endeavor known as Western Reserve University are two administrative features of special significance. One lies in the co-ordinate method of education. A college for men, Adelbert College, and a college for women exist as essential members of the same university. Each has its own faculty and government. The two bodies of students are distinct. Each college has its endowment and buildings. The work in the sciences, however, is done in the same laboratories, but usually at different times. Professors in the same departments of the two institutions exchange courses of instruction to a certain extent. The co-ordinate method is in part a co-operative method. In a State and a part of the country noted for co-education, the method prevailing in Western Reserve University is conspicuously successful. A further significant method of administration relates to the co-operative course of study established be-

tween the Case School of Applied Science and Adelbert College. These two institutions are planted upon the same campus and each has its own board of trustees. But the two faculties have arranged a course of instruction covering five years, three of which are spent in pursuing the liberal studies of the undergraduate college (Adelbert College) and the last two years are spent in the technical school (Case School of Applied Science). At the conclusion of the five-year course a bachelor of arts and a bachelor of science degree are given. Thus, the advantages of the liberal course of study are conserved and the efficiency of the specialized course also gained.

Students also may have the privilege of combining the course in Adelbert College with either the course in the Law School or the School of Medicine of Western Reserve University. The course in arts and law covers six years. The course in arts and medicine takes seven years. Both the Law School and the School of Medicine are graduate schools. Through the combined courses one year of time is saved. With the beginning of the academic year, 1918–19, women were received into the Law School. Previous to this time, the courses had been open only to men.

WESTFIELD, Mass., town in Hampden County, on the Westfield River, and on the Boston and Albany, and the New York, New Haven and Hartford railroads, nine miles west of Springfield. It is on the site of an Indian village, which was called Woronoco. The chief manufacturing establishments are machine shops, paper mills, thread mills, motorcycle, patent leather and whip factories, and cigar factories. The town has nearly 200 factories, employing 3,500 persons, with annual products of about $7,500,000. The valley in which Westfield is located is noted for its beauty; the town has a park, Woronoco, an excellent water-supply, which is brought from Montgomery Mountain, seven miles distant, and a good sewerage system. The water plant, completed in 1874, cost nearly $250,000. There are seven churches, the Noble Hospital, the Massachusetts State Normal School, a public high school, established in 1855, public and parish elementary schools, kindergartens, and a public library, which contains over 25,000 volumes. There are four banks, and a daily and a weekly newspaper. Pop. 18,411.

WESTFIELD, N. J., village in Union County, on the Central Railroad of New Jersey, about 20 miles southwest of New York. It is mainly a residential village, in a beautiful location, on an elevation. There are six churches, public and private schools, two newspapers and two banks. Pop. 8,147.

WESTFIELD, N. Y., village in Chautauqua County, on the Chautauqua Creek, and on the New York, Chicago and Saint Louis and the Lake Shore and Michigan Southern railroads, about 60 miles southwest of Buffalo, and 20 miles southwest of Dunkirk. It is in an agricultural and fruit region, in which the chief products are grapes, apples, peaches and pears. It has railroad shops, a grist-mill and fruit-basket and crate factories. There are six churches, a union school and academy, which has two endowed scholarships, and a public library, founded by Hannah Patterson by a gift of $100,000. There is a national bank and a newspaper. Pop. about 2,985.

WESTFORD, Mass., town in Middlesex County, on the Boston and Maine Railway, 6 miles southwest of Lowell. It contains several villages, and has four churches and a public library. There are manufactures of woolen goods and machinery, and agriculture and granite quarrying are carried on. Pop. about 2,851.

WESTINGHOUSE, George, American inventor: b. Central Bridge, N. Y., 6 Oct. 1846; d. New York, 12 March 1914. He entered the machine shop of his father, a manufacturer of agricultural implements, when very young and early evinced an inventive genius, designing at 15 a rotary engine. He served in the Union army in 1863–64, and in 1864–65 was assistant engineer in the United States navy, after which he studied at Union College for two years. He continued his interest in mechanics, his first invention of importance being a railway frog. In 1868 he introduced the famous Westinghouse brake (see AIR-BRAKE), which has since been developed to a remarkable degree of efficiency, and has come into international use. At first his invention was scouted as impracticable. The story is told that he interviewed Commodore Vanderbilt, and explained his designs. The Commodore is said to have replied, 'If I understand you, young man, you propose to stop a railroad train with wind; I have no time to listen to such nonsense.' A few years later the 'impossible' device was operating on all the Commodore's lines. Mr. Westinghouse was one of the pioneers in introducing alternating-current machinery, and he succeeded in securing the use of this method at the Chicago Exposition in 1893. He has also made numerous improvements in railroad signaling, and through his devices the safety of high-speed railway traveling has been greatly increased. He erected extensive works in this country and abroad for the manufacture of his various inventions, was president of over 30 corporations and proved to be as good a business man as he was a skilled mechanician. He received the Order of Leopold from the Belgian king in 1884, and in 1889 the Royal Order of the Crown from the king of Italy. He was also decorated with the French Legion of Honor. Consult Leupp, F. E., 'George Westinghouse: His Life and Achievements' (Boston 1918).

WESTLAKE, Nathaniel Hubert John, British painter, designer and writer in art: b. Romsey, 1833. He studied at Lees's, at Somerset House, under Dyce and Herbert, at the British Museum, and also at Antwerp and Paris. At the suggestion of the late W. Burges he went to a firm of glass painters to design, and afterward became art manager and partner of the firm about 1880. He has frequently exhibited at the Royal Academy, Arts and Crafts, etc. His paintings are in Saint John's Church, Richmond, Portsmouth Cathedral, Saint Augustine's, Tunbridge Wells, Bute Memorial Chapel, Cardiff Castle, Wales, the Chapel of Maynooth College, Ireland. Mr. Westlake designed glass for Saint Paul's Cathedral, London, the cathedrals of Peterborough and Wor-

cester, the Gate of Heaven Church, South Boston, Mass., the Via Crucis of Saint Francis's, Notting Hill, London. He designed Salviati's mosaic of Blessed James of Ulm at the South Kensington Museum, London, the apse mosaic in the Newman Memorial Church, Birmingham, and has colloborated with many famous architects. His publications include 'Outlines of the History of Design in Mural Painting' (3 vols.); 'History of Painted Glass' (4 vols); 'True Portraiture of St. Francis'; 'Sketches at Malines Exhibition.' He edited 'Reproduction of Royal Manuscripts, 2 B VII, British Museum'; 'Queen Mary's Psalter,' etc.

WESTLAKE, William, American inventor: b. Cornwall, England, 23 July 1831; d. Brooklyn, N. Y., 28 Dec. 1900. He came to the United States in 1847, settled in Milwaukee, Wis., and there was employed in a printing office. He was subsequently an apprentice to a tinsmith, and in 1853 made for Captain John Ericsson the models for his first hot-air engine. He entered the employ of the La Crosse and Milwaukee Railroad Company in 1857, and soon after began the series of inventions which made him famous. Among them are the Westlake car heater, the globe lantern, the first practical car lamp, the oil cook stove, the stoveboard, etc.

WESTLAND, New Zealand, a provincial district in South Island, bounded north by Nelson district, south by Otago, west by the ocean and east by Canterbury, from which it is separated by the chain of the Southern Alps. It is about 200 miles long and about 25 miles in average breadth, its area being about 4,642 square miles. It consists principally of hills branching off from the great alpine system, intersected by narrow bush-clad valleys, and merging coastward into undulating plateaus, river valleys and shelving coasts. The streams are numerous but short. Practically the whole of the district is covered with forest. Large tracts can be prepared easily for pastoral purposes, but there is little ground suitable for agriculture. Gold is found in the valleys of the rivers, especially in those of the Arahura and Waiho, and gold-bearing quartz is also worked in some places. Silver, copper, iron and tin are among the other metallic treasures of the district, which has also yielded much coal, especially from the valley of the Grey. The climate is equable and temperate. The rainfall is heavy, and snow lies on the high mountains during much of the year. The capital is Hokitika, the other chief towns being Greymouth, Brunnerton, Kumara and Ross. Railways connect Greymouth with Hokitika, Jackson and Reefton (in Nelson district). Westland was formerly part of Canterbury district. Pop. about 17,000.

WESTMACOTT, wĕst'mą-kŏt, **Richard,** English sculptor, son of Sir Richard Westmacott (q.v.): b. London, 1799; d. there, 19 April 1872. He studied under his father and also in Italy 1820-26, and after returning to England rose to prominence in his art. In 1857 he succeeded his father as professor of sculpture at the Royal Academy, having become associate member of the academy in 1838 and a full member in 1849. His style resembled that of his father in many respects He published a 'Handbook of Sculpture' (1864) and a pamphlet 'On Coloring Statues.'

WESTMACOTT, Sir Richard, English sculptor: b. London, 1775; d. there, 1 Sept. 1856. He was the son of Richard Westmacott, also a sculptor, and was early trained to a knowledge of art by his father. In 1793 he was sent to Rome to study his profession under Canova, and there gained the annual gold medal for sculpture given by the Pope at the Academy Saint Luke. He also obtained a first prize for sculpture at Florence, and was elected a member of the Academy there. In 1798 he returned to England and rose rapidly in estimation as an artist. Many of the monuments in Saint Paul's Cathedral are by him, and that building forms, in some respects, a gallery of his works. The figure of a Welsh girl in a monument to the memory of Lord Penrhyn, at Penrhyn, in North Wales, is considered by many as his best creation. He designed also the statue of Nelson in Birmingham, besides figures of Addison, Pitt and many others. He became an associate of the Royal Academy in 1805, a full member in 1811 and in 1827 succeeded Flaxman as lecturer to the academy on sculpture. He was knighted in 1837.

WESTMEATH, Ireland, inland county of the province of Leinster, having Meath on the east, Roscommon on the west, Cavan on the north and King's County on the south; greatest length, east to west, about 40 miles; greatest breadth, north to south, about 35 miles; its area is 708 square miles, or 453,468 acres, of which 111,752 are under tillage. The surface is generally level, the land is chiefly in pasture. Mullingar is the chief town, but Athlone is the great manufacturing centre. Pop. 59,812.

WESTMINSTER, London, England, a metropolitan and Parliamentary borough, formerly the ancient city and Liberty of Westminster, which still retains its civic title and certain privileges. Area, 2,502 acres. It is bounded on the south and east by the river Thames; east by the city of London, from which it was separated by the former Temple Bar; north by Holborn, Marylebone and Paddington, and west by Kensington and Chelsea. It is connected with Lambeth by Vauxhall, Lambeth, Westminster and Waterloo bridges. It has the highest valuation of any of the London boroughs (£6,821,491 in 1915), not excepting the City of London. The city contains some of the finest and most imposing buildings in London and teems with historical and literary associations. All the metropolitan royal palaces are within its limits and also Westminster Abbey, the Houses of Parliament, a fine modern Roman Catholic cathedral, the principal government buildings, the headquarters of the metropolitan police force, the National Gallery and the Tate Gallery, Burlington House, Somerset House and the principal theatres and opera-houses. It is divided into three Parliamentary constituencies, each returning one member, Saint George's, Hanover Square, the Abbey and Strand.

The History of Westminster goes back to a very early period. It became a city when, in 1540, Henry VIII made it the see of a bishop, and even though the see was suppressed 10 years later it retained the right to the style of city. The only (Anglican) bishop of Westmin-

ster was Thomas Thirlby. Since 1831 a branch of the Grosvenor family has borne the title of marquis, and since 1874 of Duke of Westminster. In 1850 a Roman Catholic archiepiscopal see of Westminster was created by Pope Pius IX, the first occupant being Cardinal Wiseman. Pop. about 160,261. Consult Besant, 'Westminster' (1895); Terry, 'Greater Westminster' (1899); Walcott, 'Westminster' (1849). See LONDON.

WESTMINSTER, Md., city, county-seat of Carroll County, on the Western Maryland Railroad (Wabash System) about 35 miles northwest of Baltimore. The city is in an agricultural section, but it has considerable manufacturing interests. The chief industrial establishments are flour-mills, carriage factories, canneries and cigar factories. In the canning season about 500 employees are engaged in the canning factories. There are nine churches. The educational institutions are the Western Maryland College (Methodist Protestant), opened in 1868; public and parish schools. There are three national and two savings banks. The government is vested in a mayor and common council of five members, elected annually. The place was settled in 1724 by persons from the north of Ireland and a colony of English from Prince George County, of which at that time it was a part. Some Germans were also among the first settlers. The inhabitants are nearly all American born, descendants of Germans, Irish, English, Dutch and French. Pop. about 3,310.

WESTMINSTER, Order of the Holy Cross of. See ORDERS, RELIGIOUS.

WESTMINSTER ABBEY. See LONDON, *Church Buildings*.

WESTMINSTER ASSEMBLY OF DIVINES, a celebrated assembly held in the middle of the 17th century for the settlement of a general creed and form of worship throughout Great Britain, at a time when Presbyterianism had gained a strong position in England as well as in Scotland. On the 23d of Nov. 1641 the House of Commons (Long Parliament) addressed to the king a remonstrance desiring a synod of the most learned and pious men throughout the island for the settling of the government of the Church; but it was not till 1643, after the civil war had begun, that an ordinance was passed (on 12 June) convoking the long-proposed assembly of divines. By this act 121 clergymen, with 10 lords and 20 commoners as lay assessors, were nominated as constituents of the assembly. The assembly began its sittings on 1 July 1643 in Henry VII's Chapel, at Westminster Abbey, but in the meantime a proclamation forbidding the assembly to meet had been issued by the king on 2 June, which had the effect of inducing the greater part of the Episcopal members to absent themselves, and Episcopacy was thus almost entirely unrepresented. The majority of those who remained were Presbyterians, but there was a powerful and energetic minority of Independents. A deputation was now sent along with commissioners from the English Parliament to the general assembly of the Scottish Church and the Scottish Convention of Estates, soliciting their co-operation in the proceedings of the Westminster Assembly, and accordingly on 15 September four Scottish clergymen, Alexander Henderson, George Gillespie, Samuel Rutherford and Robert Baillie, with two laymen, Lord Maitland and Sir Archibald Johnston of Warriston, were admitted to seats and votes by an act of the English legislature. The assembly continued to hold its sittings till 22 Feb. 1649. Among the results of its deliberations were the 'Directory of Public Worship,' which was presented to Parliament on 20 April and ratified on 2 Oct. 1644; the 'Confession of Faith' presented to Parliament in October and November 1646 and ratified with a few verbal alterations in March 1648; the 'Shorter Catechism,' presented to the House of Commons on 5 Nov. 1647 and the 'Longer Catechism' on 15 Sept. 1648. In the latter period of the sittings of the assembly the growing power of the Independent party in Parliament presented a serious obstacle to the carrying into effect of its recommendations, though in 1648 an order of Parliament was pronounced declaring "all parishes and places whatsoever," with the exception of chapels for the king and peers, to be under the Presbyterian form of church government. The accession of Cromwell to power destroyed the hopes of the Presbyterians, and on the Restoration the whole proceedings of the Westminister Assembly, with the ratification of Parliament, were annulled as invalid.

While this celebrated convocation was thus allowed, as regards England, to remain almost inoperative, its deliberations have left on Scotland and on Presbyterianism as established in the United States, an impress which will never be effaced. The present standards of the Presbyterian churches are made up of the various formularies above enumerated. They were ratified by the Scottish General Assembly as follows: The 'Directory of Public Worship' in February 1645; the 'Confession of Faith' in August 1647, and the 'Longer and Shorter Catechism' in July 1648. Consult Hetherington's 'History of the Westminster Assembly' (1843; 6th ed. 1891); the 'Minutes of the Assembly,' edited by Mitchell and Struthers (1874); Mitchell's 'The Westminster Assembly' (1883); 'Cambridge Modern History' (Vol. 4, New York 1906), etc. See PRESBYTERIANISM.

WESTMINSTER COLLEGE, located at Fulton, Mo. It was founded in 1853 by the Missouri Synod of the Presbyterian Church. Though badly crippled during the Civil War by reduction in numbers and loss of endowment, the college continued its work throughout the war. In 1892 a bequest of nearly $120,000 for permanent endowment was received and in 1897 the Alumni Association began a movement for further increase of this fund. In 1901 an amendment of the charter placed the college under the joint control of the Southern and the Northern synods of Missouri. The college formerly conferred the three degrees of A.B., B.L. and B.S. for the completion of the classical, literary and scientific courses respectively; but recently arranged its course in three groups corresponding to the former three courses, and confers the single degree of A.B. Each group includes required and elective studies. Bible study is required and Hebrew is among the electives. There is also an academy offering a classical and a literary and

scientific course and commercial courses. The campus comprises 18 acres on a wooded slope bordering on Stinson Creek. There are now four buildings, and productive funds totaling $247,219. The library contains over 10,000 volumes; the students average annually 170 and faculty 16.

WESTMINSTER COLLEGE, located at New Wilmington, Pa. It was chartered in 1852, as Westminster Collegiate Institute under the auspices of the United Presbyterian Church. The board of trustees now consists of 40 members, the majority of whom are elected by two synods of that Church. The name was changed to Westminster College in 1892. The college offers two four year courses, leading to degrees, the classical and the scientific, and confers the degrees of A.B. and B.S. The work of the scientific course is mostly required; that of the classical course largely elective in the junior and senior years. Greek is required for the A.B. degree. There are also a three years' preparatory course, a department of music and an art department. Students maintain four literary societies. Any student taking more than one study of the classical course is required to belong to one of these societies. There is no general athletic association, but a football association, baseball association, etc. The college has a pleasant situation on elevated ground, some parts of the campus commanding a fine view. The buildings are the main building, scientific hall, the ladies' hall and the gymnasium. The productive funds in 1917 totaled $498,201. The students average annually 250, the faculty 22.

WESTMINSTER CONFESSION OF FAITH. See CONFESSION OF FAITH, WESTMINSTER.

WESTMINSTER HALL. See LONDON, *Houses of Parliament.*

WESTMINSTER PALACE, London, England, an alternative name for the Houses of Parliament, perpetuated from the ancient palace built by Edward the Confessor as a royal residence and which contained the various national administrative and judicial offices. With the exception of the great hall, the building was destroyed by fire in 1834. The site is occupied by the new palace of Westminster or Houses of Parliament. See LONDON, *Houses of Parliament.*

WESTMINSTER SCHOOL, an ancient English public school established in Westminster Abbey by Henry VIII, and refounded in 1560 as Saint Peter's College by Queen Elizabeth. The school buildings closely adjoin the abbey, several of them having once been a part of the domestic buildings of the abbey, the great schoolroom being originally the monks' dormitory; others, such as Ashburnham House, belonging to the Post Reformation period. The institution was reorganized in 1868 as one of the seven principal public schools of England. The Westminster play, for which this school is noted, is a yearly performance by the pupils of some Latin comedy. Many eminent Englishmen have been educated at this school. Consult Forshall, 'Westminster School, Past and Present' (1884); Barker and Stenning, 'Westminster School Register' (1893).

WESTMINSTER STANDARDS. See PRESBYTERIANISM.

WESTMOUNT, Canada, city in Hochelaga County, province of Quebec. It is a residential suburb of the city of Quebec. Pop. 14,579.

WESTON, Edward, American electrician: b. London, England, 9 May 1850. He came to the United States in 1870 and engaged as chemist to a nickel-plating company. He devised various improvements in the process of nickel-plating and invented several dynamo-electric machines, establishing at Newark, N. J., in 1875, the first factory in America devoted exclusively to the manufacture of the latter class of machines. After the consolidation of his plant with another company in 1881 he continued as its electrician until 1888. He has since devoted his attention to the improvement of appliances for lighting by electricity and has introduced improvements in both arc and incandescent lighting. He was one of the founders of the American Institute of Electrical Engineers, of which he was president in 1888.

WESTON, Edward Payson, American pedestrian: b. Providence, R. I., 15 March 1839. In his youth he was a reporter on the New York *Herald* and was valued because of his ability to bring his night copy back to the office on foot quicker than could others traveling on the horse-cars of the period. He attracted attention in 1861 by walking 443 miles in 208 hours to attend the inauguration of Abraham Lincoln. His professional career began in 1867, when he walked 1,326 miles from Portland, Me., to Chicago, in 26 days. Later he engaged in six-day races, first in the effort to make 500 miles in a week, and when that record was passed he learned to run and created higher records. Some years later he again took to long walks on the highway, and in 1907 repeated his trip from Portland, Me., to Chicago, bettering the time 29 hours. Next he walked from New York to San Francisco, 3,895 miles (1909), in 104 days, 7 hours. The following year he walked back to New York, 3,500 miles, in less than 77 days. He has lectured on pedestrianism and temperance in numerous cities of the United States and England.

WESTON, W. Va., town, county-seat of Lewis County, on the West Fork of the Monongahela River and on the West Virginia and Pittsburgh Railroad, about 78 miles south of Wheeling and 71 miles southeast of Parkersburg. It is in an agricultural region, in which considerable attention is given to stock-raising. It has a flour-mill, lumber and planing-mill and machine shop. A State hospital for the insane is located here. The two banks have a combined capital of $150,000. Pop. about 2,780.

WESTPHALIA, west-fā'lĭ-ą, or **WESTFALEN,** vĕst"fä'lĕn, Germany, a name originally given (1) to a large region of Germany; (2) to a duchy; (3) to an ancient imperial circle; (4) to a kingdom; (5) to a province of Prussia. These various divisions will be described in the above order.

1. The name of Westphalia was given from the second half of the 8th century to the western part of the ancient Duchy of Saxony incorporated by Charlemagne in the kingdom of the Franks, that is, to all the country between

the Weser and Rhine while the territory between the Elbe and Weser was called Eastphalia (Ostfalen). The latter name was lost after the dissolution of the Duchy of Saxony in 1180; the former was retained and was applied in the first place to a newly-erected duchy.

2. Duchy of Westphalia.— This was formed out of the part of the old Duchy of Saxony, then and still called Süderland or Sauerland, on the Upper Ruhr and Lenne. When Henry the Lion, the last of the old dukes of Saxony, was put under the ban of the empire, this territory was taken possession of by Philip of Heinsberg, achbishop of Cologne, who obtained the title of duke from Frederick Barbarossa. Cologne remained in possession of it until the dissolution of the archbishopric in 1801, upon which it was given, by way of indemnity, to Hesse-Darmstadt. In 1815 it was ceded by this power to Prussia and was united with the Prussian province of Westphalia.

3. Circle of Westphalia, one of the 10 circles into which the empire of Germany was divided by Maximilian I in 1512. It comprised the region between Lower Saxony, the Netherlands, Thuringia and Hesse, as well as considerable tracts on the left bank of the Rhine; but the proper Duchy of Westphalia, as an appendage of Cologne, was considered as belonging to the electoral circle of the Rhine. Its total area was 22,175 square miles.

4. Kingdom of Westphalia.— The Peace of Tilsit (July 1807) had made Napoleon master of all the Prussian territory west of the Elbe and he also kept possession of the territories of the electors of Hesse and Hanover and the Duke of Brunswick. Out of the countries just mentioned he created by decree of 18 Aug. 1807 a kingdom of Westphalia, with an area of 14,712 square miles and a population of nearly 2,000,000. Napoleon gave the kingdom to his youngest brother, Jerome, and on 15 Nov. 1807 a constitution similar to the French was granted to it. The insurrections that broke out in several parts in 1809 occasioned the adoption of various severe measures, and the introduction of an oppressive system of police. At the same time the king was required to bring his army up to a strength of 30,000 men, which produced great disorder in the finances. In 1810 a part of Hanover was added to the kingdom, the whole area of which was now 17,540 square miles. After the battle of Leipzig (1813) the kingdom was dissolved. On 26 October, Jerome was obliged to quit his capital (Cassel) and make his escape from the kingdom, whereupon the territories of which it was composed returned to their former possessors.

5. The Prussian Province of Westphalia was formed in 1815 out of some of the provinces which Prussia formerly possessed in the circle of Westphalia. It is bounded on the north by the province of Hanover; on the east by Hanover, Schaumburg-Lippe, Lippe-Detmold, Brunswick, Hesse-Nassau and the principality of Waldeck; south by the province of Hesse-Nassau, and west by the province of the Rhine and the kingdom of Holland. Its area is 7,800 square miles. The capital is Münster. The province in the south and northeast is generally mountainous, being traversed by the Westerwald, Rothhaar, Teutoburgerwald and the Wesergebirge. The northwest spreads out into extensive and often marshy plains and belongs to the basin of the Ems; the northeast and a small part of the east to the basin of the Weser; the remainder, constituting the far larger portion of the whole, belongs to the basin of the Rhine. The soil is in general far from fertile. Livestock are numerous, particularly horned cattle, sheep and swine; the hams made from the latter have long been famous. The staple manufacture is linen, but that of iron is also very extensive. The region possesses the principal Prussian deposits of iron and coal and these were heavily drawn upon during the World War. Other minerals mined include copper, lead, zinc and salt. The province is divided into the three governments of Münster, Minden and Arnsberg. The population is about 4,250,000.

WESTPHALIA, Peace of, the treaty concluded in 1648 at Münster and Osnabrück, Westphalia (q.v.), which ended the Thirty Years' War and established a new political system in Europe. After preliminaries had been settled at Hamburg toward the end of 1641 the actual negotiations were begun in 1644, at Osnabrück, between the empire, Sweden and the Protestant states, at Münster between the empire, France and other foreign powers. Two treaties were drawn up, one at Osnabrück, signed 6 Aug. 1648, and one at Münster, signed 24 Oct. 1648. Peace was restored with the signing of the latter. By this peace the religious and political state of Germany was settled. The sovereignty of the members of the empire was acknowledged. They received the right of concluding treaties among themselves and with foreign powers, only not against the emperor and empire. Their consent was made necessary to enable the emperor to put any of the members under the ban. The concessions that had been made to the Protestants since the religious peace in 1555 were confirmed. The form of public worship and the right to secularize ecclesiastical benefices were to return to what they were at the beginning of the so-called normal year 1624. The Calvinists (Reformirten) received equal rights with the adherents of the Augsburg Confession or the Lutherans. The elector-palatine had the palatinate of the Rhine and the electorate restored to him; Alsace was ceded to France; Sweden received western Pomerania, Bremen, Verden, Wismar and a sum equal to $3,750,000; Brandenburg, Mecklenburg, Hanover and Brunswick were compensated by the secularization of numerous ecclesiastical foundations. Germany lost altogether more than 40,000 square miles of territory and about 4,500,000 inhabitants. The independence of the United Provinces was recognized by Spain, and that of Switzerland by the empire. The solemn protest of Pope Innocent X against these terms, particularly in respect of the secularization of bishoprics and abbeys, etc., was not regarded; but the complete execution of the treaty was obstructed by many difficulties.

WESTPORT, Conn., town in Fairfield County, on Long Island Sound at the mouth of the Saugatuck River, and on the New York, New Haven and Hartford Railroad, four miles east of Norwalk. It was established from portions of the towns of Weston, Fairfield and Norwalk. Westport contains three villages. It

is in an agricultural region and has a number of industrial establishments, chief of which are cotton-twine and button factories, machine shops and manufactories of satchels and morocco. It has a high school, elementary schools and a public library. There are two banks and a newspaper. Pop. about 4,259.

WESTPORT, Ireland, small seaport of the province of Connaught, county Mayo, at the mouth of a small stream that falls into Clew Bay, about 35 miles north-northwest of Galway. Formerly Westport was supported principally by linen manufactures; but is now known mostly for its trade in grain and provisions, and for its facilities for sea-bathing. In the immediate vicinity is the Reek Croagh Patrick, a mountain 2,510 feet high. Pop. about 4,000.

WESTPORT, Mass., town in Bristol County, on the Atlantic Ocean, seven miles south of Fall River. Its Horseneck Beach is one of the finest beaches on the coast. There are manufactures of cotton products. Pop. 2,928.

WESTVILLE, Ill., village in Vermilion County, 128 miles south of Chicago, on the Chicago and Eastern Illinois and the Cleveland, Cincinnati, Chicago and Saint Louis railroads. Its industries include coal mining and steel manufactures, and considerable corn is raised in the surrounding district. Pop. 2,607.

WESTWARD HO, one of the best known historical novels of Charles Kingsley, was begun in the spring of 1854 while Kingsley was living at Bideford and appeared the following year. The scene, laid chiefly in Bideford and at Plymouth and neighboring parts in the west of England, deals with the sea-faring English about the time of the Spanish Armada. The attempt is to picture the spirit of the English in their warfare against Spain. Historical characters, as Drake and Raleigh, are introduced, but the particular story is that of Amyas Leigh, his brother Frank and other members of the League of the "Rose of Torridge," so called from the beautiful heroine for whose hand these chivalrous and high-minded youths were rivals. Their individual rivalry was merged in the common cause against Spain, in which several, including Frank Leigh and the Rose, met their deaths. Finally Amyas, a stout-hearted young giant who had been particularly successful in vanquishing Spaniards, losing his eyesight, was obliged to pass the long remainder of his life in helplessness. The picture is a spirited one, though by no means in all respects historically accurate. The character and achievements of the English and the wiles and wickedness of the Spanish are painted with unstinting hands. As is usual in Kingsley's best-known works, like 'Alton Locke' and 'Hypatia,' even such chivalrous achievements do not constitute the best end of life. Only when Amyas Leigh, blind and helpless, can turn from an active to a spiritual life, is his highest happiness won.

WILLIAM T. BREWSTER.

WESTWOOD, John Obadiah, English entomologist and archæologist: b. Sheffield, England, 22 Dec. 1805; d. Oxford, England, 2 Jan. 1893. He devoted himself to sciences, making extensive researches in the fields of entomology and archæology; was one of the founders of the Entomological Society of London in 1833, and from 1883 its honorary life president. From 1861 until his death he was professor of invertebræ zoology at Oxford. His works on both entomology and English archæology are numerous and important. Among the former are 'The Entomologists' Text-Book' (1838); 'Introduction to the Modern Classification of Insects' (1839–40); 'Arcana Entomologica' (1841–45); 'The Butterflies of Great Britain' (1855); 'Catalogue of Orthopterous Insects in the British Museum, Part I, Phasmidæ' (1859); 'Thesaurus Entomologicus Oxoniensis' (1874); 'Revisio Insectorum Familiæ Mantidorum' (1889), etc. His archæological works, which are enriched by his excellent reproductions of manuscripts and illuminations and also by his drawings of inscribed stones and old ivories, are well known. Among them are 'Palæographia Sacria Pictoria' (1843–45); 'Wood Carvings' (1864); 'The Utrecht Psalter' (1874); 'The Early Inscribed and Sculptured Stones of Wales' (1876–79); 'The Book of Kells: a Lecture' (1887), etc.

WET BULB THERMOMETER. See THERMOMETER.

WETASKIWIN, Canada, city and capital of Strathcona district, province of Alberta, 40 miles south of Edmonton and on the Canadian Pacific Railroad. It is situated in a rich agricultural district and is of growing importance as a manufacturing town. Pop. 2,411.

WETHERALD, Agnes Ethelwyn (Mrs. THISTLEWAITE), Canadian poet: b. Rockwood, Ontario, 26 April 1857. She was educated at Pickering College, Ontario. For some time she edited the women's department of the Toronto *Daily Globe*, and she was subsequently connected with the staff of the *Ladies' Home Journal*. Her verse appeared in numerous magazines and she is author of 'The House of Trees' (1896); 'Tangled in Stars' (1902); 'The Radiant Road' (1904); 'The Last Robin' (1907), etc.

WETHERELL, wĕth'ĕr-ĕl, **Elizabeth.** See WARNER, SUSAN.

WETHERELL, Emma (Abbott), American soprano opera-singer: b. Chicago, Ill., 9 Dec. 1849; d. 5 Jan. 1891. She first sang in public at the age of nine. Through the patronage and friendship of Clara Louise Kellogg she was enabled to go to New York 1870, where she was engaged in the choir of the church of the Divine Paternity, a number of whose members in 1872 contributed to send her abroad, and she studied for four years in Paris. She made her début in London 1876 as Marguerite. For refusing to take the part of Violetta, in 'La Traviata,' on moral grounds, her engagement was canceled. In 1874 she was married to Eugene Wetherell. She made her first appearance in New York in 1877.

WETHERSFIELD, wĕth'ĕrz-fēld, Conn., town, Hartford County, on the Connecticut River and on the New York, New Haven and Hartford Railroad, three miles south of Hartford. In the summer it has regular steamer connections with New York and intermediate ports and it is connected with Hartford and other nearby places by electric railways. It has manufactories of mattresses, copying presses and agricultural implements. Important industries of the town are connected with the cultivation of seeds and the packing and shipping of

the same. It was one of the first places in the State settled by the colonists. It has a famous elm tree 26.6 feet in circumference. The First Church (Congregational) dates from 1761. A historic building is the Webb house, where, in 1781, Washington and Rochambeau met. A State prison is located here. The educational institutions are a high school, public and private schools and a public library. Pop. 3,500.

WETMORE, Claude Hazeltine, American author: b. Cuyahoga Falls, Ohio, 1862. He was educated at Western Reserve University, Cleveland, Ohio, and the École Polytechnique, Lausanne, Switzerland, and subsequently spent 10 years in South American travel. He has published 'Sweepers of the Sea' (1900); 'Fighting under the Southern Cross' (1901); 'In Incaland' (1902); 'In a Brazilian Jungle' (1903).

WETMORE, Edmund, American lawyer: b. Utica, N. Y., 1838. He was graduated at Harvard University in 1860 and at the Columbia University Law School in 1863. He was thereafter engaged in law practice in New York and became one of the most prominent lawyers in the city. In 1900-01 he was president of the American Bar Association. The degree LL.D. was conferred upon him by Yale University in 1906.

WETMORE, Elizabeth Bisland, American author: b. Fairfax Plantations, La., 11 Feb. 1861. She was privately educated, and was for a time on the staff of the New Orleans *Times-Democrat*. She later established herself in New York, became one of the editors of the *Cosmopolitan Magazine* and was known as a magazine writer. She was married to C. W. Wetmore in 1891, and has lived much in England. Her work, published under her maiden name includes, 'A Flying Trip Around the World' (1891); 'A Candle of Understanding' (1903); 'At the Sign of the Hobby Horse' (1910); 'The Case of John Smith' (1916), etc. She edited 'Life and Letters of Lafcadio Hearn' (2 vols., 1906); 'Japanese Letters of Lafcadio Hearn' (1910).

WETTER, vĕt'tĕr, Sweden, a lake about 24 miles southeast of Lake Wener, extending between the läns of Mariestad, Örebro, Linköping, and Jönköping; greatest length, 80 miles; medium breadth, about 15 miles; area, 715 square miles. Its height above the level of the Baltic is nearly 300 feet, but its depth is in some parts above 400 feet, or 120 feet below the Baltic level. Its water is very clear. It has periodic rises and falls independent of the wetness or dryness of the season and is subject, even in the calmest weather, to violent underground swells. When these take place in winter the sounds emitted by the ice in cracking and breaking up are often tremendous. An underground ridge is traceable throughout the whole length of the lake from north to south and its culminating points form the few islands which appear above its surface. The largest of these is the Visingsö, in the south. The Wetter forms part of a general line of navigation, which extends across the kingdom from east to west and far into the interior. By the Gotha Canal it communicates with Lake Wener, and by the Motala Canal with the Baltic. The scenery of the lake is in many places magnificent; the chief town on its shore is Jönköping.

WETTERHORN, vĕt'tĕr-hôrn ("peak of tempests"), Switzerland, one of the most striking peaks of the Bernese Oberland; has three summits — the west, called by the natives Hasli-Jungfrau, 12,147 feet high; the middle, known as the Mittelhorn, 12,165 feet; and the east, the Rosenhorn, 12,110 feet. These were ascended first in 1844 and frequently since, the ascent being made from Grindelwald. The contrast between the bright fresh pastures and the black precipices and dazzling snow ridges of the Wetterhorn is particularly striking, making the valley of the Reichenbach a favorite resort of artists.

WEXFORD, Ireland, maritime county of the province of Leinster, bounded north by the county of Wicklow, east by the English Channel, south by the Atlantic, west by the counties of Waterford, Kilkenny and Carlow; greatest length, north and south, about 60 miles; greatest breadth, east and west, 34 miles; area is about 901 square miles, or 576,588 acres. Pop. about 104,100.

WEXFORD, wĕks'fôrd, Ireland, a seaport town, capital of the county of the same name, at the mouth of the River Slaney. The town is irregularly built and the streets narrow, but it contains some handsome buildings. It has a county courthouse, town hall, prison, theatre, barracks, etc.; three Roman Catholic churches, besides several Protestant places of worship, nunneries, a Roman Catholic college and various schools. Above the town there is a bridge across the river 1,500 feet in length. Wexford was a Danish settlement of great strength; it was captured by Cromwell in 1649; remains of its ancient walls exist. The harbor is spacious, but has a bar across the mouth. There is a dockyard and patent slip. The herring and salmon fisheries employ many persons; malt, agricultural implements and machinery are manufactured and distilling and brewing are carried on. The chief trade consists in the exportation of grain, cattle, poultry, butter, etc. In 1885 Wexford ceased to be a parliamentary borough. Pop. 11,154.

WEYBURN, Canada, town and capital of Assiniboia district, Saskatchewan, 300 miles southwest of Winnipeg, on the Canadian Pacific Railroad. The manufactures of the town are of growing importance. Pop. 2,210.

WEYDEN, vī'dĕn, **Rogier van der,** Flemish painter: b. Tournay, about 1400; d. Brussels, 16 June 1464. In 1426 he was apprenticed to learn painting, in 1432 became master in the painters' guild of Tournay, and in 1436 was chosen town artist of Brussels. His four works illustrating justice, executed for the "golden chamber" of the Hôtel de Ville, were destroyed by fire in 1695. In 1449 he journeyed to Italy, where he worked at Ferrara for Leonella d'Este, and painted also for the Medici and the Sforzas. He was the founder of the Brabant school. Among his principal extant works are a triptych in the Belvidere of Vienna; a triptych, 'The Last Judgment,' in the Beaune Hospital; and 'The Descent from the Cross' (Madrid gallery). Consult the study by Wauters (1856); and Crowe and Cavalcaselle, 'Early Flemish Painters' (3d ed., 1879).

WEYER'S (wī'ĕrz) **CAVE,** in Augusta County, Va., 11 miles northeast of Staunton.

Whalebone Whales.— Whalers recognize several species of groups of whales with whalebone, to which they give the names of right whales, humpbacks, finbacks and sulphurbottoms. These correspond to natural groups or genera, except that the sulphurbottom is really a kind of finback. To these are to be added the California gray whale, or grayback, a very distinct genus, combining characters of right whales and finbacks, and the pygmy right whale of New Zealand. These various genera may be distinguished by the following external characters:

Humpbacks (genus *Megaptera*).— Form bulky and uncouth. Head broad and rounded in front, and flat on top, with rows of hemispherical tubercles. Belly with many broad longitudinal ridges and furrows. Pectoral fins very long (about one-third the length of the body), with serrations corresponding to the joints of the index finger. A low, thick dorsal fin. Flukes with a serrated margin. Color black and white. Whalebone short, dull blackish.

Finbacks (genus *Balænoptera*).— Form slender and graceful. Head broad and flattish, more or less pointed in front. Belly with very numerous narrow ridges and furrows. Pectoral fins short, with plain margins. A falcate dorsal fin. Color gray and white. Whalebone short, striped gray and white, or entirely black, or black with white bristles, or entirely white.

California Gray Whale (genus *Rhachianectes*).— Form rather slender. Head comparatively narrow, moderately arched and pointed. No abdominal ridges or furrows, but two short furrows on the throat. No dorsal fin. Pectorals short. Color mottled gray. Whalebone short, white.

Right Whales (genus *Balæna*).— Form heavy and compact. Snout very narrow, and strongly arched. No ridges or furrows. No dorsal fin. Pectoral short and very broad. Color entirely black, or with a little white below. Whalebone very long, narrow, black.

Pygmy Right Whale of New Zealand (genus *Neobalæna*).— Similar to *Balæna*, but size small. A dorsal fin present. Whalebone white.

Humpbacks.— The humpback is in many respects the most remarkable of all whales. It reaches a length of about 50 feet. The anterior part of the body is very massive, but the posterior quite slender and at the same time so irregularly shaped and so awkwardly joined to the thorax that the animal appears misshapen. This effect is heightened by the dorsal fin, which is low and thick, with a concave anterior margin and rounded tip. Not less striking are the immense crenate-margined pectoral fins, like the wings of a bird, and about one-third as long as the body. The broad abdominal ridges nearest the median line join below on the throat, forming a chin-like protuberance. Humpbacks are infested by large barnacles of the genus *Coronula*, which fasten on the head, fins, flukes and abdominal ridges. Where they settle on the black skin but are afterward rubbed off, or otherwise got rid of, they leave behind distinct white marks, in the form of discs, circle, crescents, etc., which add to the singular appearance of these whales. Fastened to the large barnacles, are often bunches of stalked barnacles, genus *Otion*, which hang down like fringes on the fins. Some 9 or 10 species of humpbacks have been described, but wherever observed they present characters so nearly alike that it is extremely probable that all belong to one widely-diffused species. The species of the Atlantic Coast of North America and Europe is *Megaptera nodosa*. Humpbacks occur in all seas, from the Arctic to the Antarctic. They congregate in bands, or schools, which sometimes number hundreds or even thousands of individuals. They are very irregular in their movements and indulge in all manner of uncouth actions. When they dive or sound they throw the flukes out of the water. Like other cetaceans they engage in seasonal migrations northward and southward. In the North Atlantic they withdraw from the waters of Greenland, Newfoundland, Iceland and Norway in fall and return in spring. They feed chiefly on fish.

Sulphurbottom, or Blue Whale (*Balænoptera musculus*).— The sulphurbottom, as already stated, is a species of finback. Wherever finbacks are observed there are found to be four distinct forms. Each of these has been described from different localities under different names, but the variations are slight in each case, and have never been fully established, so that there is a strong probability that there are but four cosmopolitan species. These are the sulphurbottom, the common finback, the pollack whale and the little piked whale. Each form will now be considered separately, beginning with the sulphurbottom. The sulphurbottom is the largest of whales and the largest of all animals now existing, and was probably not surpassed in size by any animal living in earlier geological times. The largest individual of which there are authentic measurements was 88½ feet long. The average length for adults is about 76 feet. The sulphurbottom has a massive head and broad snout, and the body tapers gradually to the flukes. The dorsal fin is falcate and less than a foot long, and is situated at a point a little more than three-fourths the distance from the top of the snout to the notch of the flukes. The pectoral fins are falcate and about seven and one-half feet long, from the axilla. In color the sulphurbottom is gray, nearly uniform on the head, but mottled on the back and sides. On the belly are numerous white spots. The pectoral fins are gray above and white below, the flukes gray on both sides and the dorsal fin also gray, sometimes with a whitish centre. The abdominal ridges number 62 to 88. The whalebone is about three feet long, broad at the base and black in color, both plates and bristles. These huge whales feed exclusively on small crustaceans, the species in the North Atlantic being the thysanopod *Euphausia inermis*. The sulphurbottom congregate in the bays of southern Newfoundland, Iceland and northern Norway in early spring and remain until about July. Some individuals, however, appear to remain throughout the year, and their migrations are irregular and not well understood. They rarely strand on the east coast of the United States, nearly all the individuals reported as such belonging to the next species, the common finback.

Common Finback (*Balænoptera physalus*). —This is the most commonly observed and best

known of the finbacks. In size it ranks next to the sulphurbottom. The form is exceedingly attenuated. Adult individuals reach an average length of 65 feet. The head is narrow anteriorly. The dorsal fin exceeds a foot in height and is situated as in the sulphurbottom. The pectoral fins are small, somewhat triangular, and about five feet long, from the axilla. This whale is gray on the back and upper surfaces of the pectoral fins and flukes and white on the belly and the under surfaces of the pectoral fins and flukes. The whalebone as a whole is gray, striped longitudinally with white, but at the anterior end of the jaw on the right side the whalebone is all white. The outside of the right lower jaw is also white. These parts are dark on the left side. This singular asymmetry of coloration is peculiar to, and characteristic of, the species. The common finback feeds on various kinds of small fish, especially the capelin, herring, young cod, etc.

In the North Atlantic it appears in spring in Massachusetts Bay, the Gulf of Maine, about Newfoundland, and in Greenland waters, as well as on the coasts of northern Europe. In the fall it withdraws from these waters and is supposed to migrate southward. The large whales which strand on the east coast of the United States are almost invariably of this species. When swimming or rising to spout, this whale, like the sulphurbottom, shows the top of the head and back and the dorsal fin, but nothing beyond. The flukes are not thrown out of the water when it dives or sounds.

Pollack Whale, or Rudolphi's Rorqual (*Balænoptera borealis*).—This is a smaller whale than either of the preceding, adults reaching a length of about 45 feet. The form is more compact, the dorsal fin larger and more anteriorly placed. It is black on the back and sides, with a restricted gray or whitish area on the belly. The pectoral fins and flukes are dark gray, both above and below. The whalebone plates are black, but the bristles white. This whale, like the sulphurbottom, feeds on small crustaceans. Although large numbers of individuals were taken on the northern coast of Norway in some years when the fishery was at its height, it appears to be less abundant than the larger species. It was not positively known to occur on the east coast of North America until 1903, when four specimens were taken at the Newfoundland whaling stations. It cannot yet be considered more than a straggler in American waters. A similar, or identical, species has been observed in the Pacific Ocean, but little is known regarding it.

Little Piked Whale, or Lesser Finner (*Balænoptera acuto-rostrata*).—This is the smallest of the finbacks and is not sought for by whalers. The form is thickset like that of a porpoise and the head pointed. When adult, it is about 25 feet long, and the maximum length is about 28 feet. The dorsal fin is larger than in any of the other finbacks and is situated farther forward, or at a point only about two-thirds the distance from the tip of the snout to the notch of the flukes. It is very dark gray or blackish on the back and sides and white on the belly, a little clouded with gray. The pectoral fins are blackish above, with a broad cross-band of white near the middle; below they are white. The flukes are blackish above and whitish below. In this species the abdominal ridges are very numerous and narrow. The whalebone is very short and entirely white. The little piked whale feeds upon fish. It is found with the other species of finbacks in the North Atlantic, migrating northward and southward in the same manner, according to the season. A few specimens have been observed on the coast of New England, New York and New Jersey, either stranded or entangled in the nets of the fishermen. Whales of the same size and form and with the same peculiar markings have been observed on the coast of New Zealand, Argentina, Washington, Alaska and in other widely separated localities.

California Gray Whale, Grayback or Devilfish (*Rhachianectes glaucus*).—This remarkable whale is found only in the North Pacific. Its characters have been already enumerated above. When full-grown it has a length of about 40 feet. It is a restless and sagacious animal, and when wounded frequently attacks the boats sent out for its capture. In earlier days it was found abundantly in the winter months in the lagoons and bays of Lower California whither it repaired to breed. It is fond of playing in the surf and approaches close inshore to indulge in this recreation without fear of stranding. The gray whale is found as far northward as Bering Sea and occurs also on the coast of Japan, but has no counterpart in other seas.

Greenland Right Whale, Arctic Right Whale, or Bowhead (*Balæna mysticetus*).—In reviewing the observations of earlier zoologists, Cuvier came to the conclusion that but one species of right whale existed in the North Atlantic and Arctic oceans, an erroneous opinion, which nevertheless was accepted until the Danish cetologist, Eschricht, proved that the right whale of the Arctic was quite distinct from the species occurring farther south. This Arctic right whale, or bowhead, as it is called by American whalers, is most remarkable in appearance. The snout is narrow and arched like a bow. From the roof of the mouth depends the extraordinary, narrow black whalebone, which may be 12 feet long or even longer. This whalebone is enclosed and protected by the immense oblong lower lip, the curved upper edge of which fits against the side of the upper jaw when the mouth is shut. The back is without a fin, while the pectorals are short, and broad. There are no ridges or furrows on the belly. Adults reach a length of about 60 feet. The bowhead rarely or never leaves the Arctic ice, but like other whales it migrates northward and southward with the changes of the seasons. On the east coast of America it is never seen as far south as the southern extremity of Greenland, though there is a tradition that at the time of the discovery of the country it ranged as far south as the Strait of Belle Isle in winter. It occurs in the Arctic Ocean north of Alaska and ranges southward into Bering Sea. Individuals are believed to pass back and forth through the channels between the islands north of the continent from the eastern to the western side. The bowhead feeds chiefly on small pteropod mollusks and crustaceans which occur in vast multitudes in the Arctic Ocean. It is the most valuable of whales from a commercial point of view, on account of the thickness of the blubber and the length and fine quality of the whalebone, which

at present commands exceedingly high prices. its constant pursuit for three centuries has now very greatly diminished its abundance.

Atlantic Right Whale, or Black Whale (*Balæna glacialis*).— This whale resembles the bowhead in general appearance, but the head is smaller and less arched, and the whalebone shorter, or only about seven feet long. Near the end of the snout is a low rounded protuberance, called the "bonnet" by whalers. This bonnet is covered with barnacles, which are not found adhering to the bowhead. The black whale, as its name implies, is usually entirely black, but some individuals have been reported as whitish or grayish on the throat and breast. When full-grown it reaches a length of about 50 feet. Like the bowhead it feeds upon crustaceans and pteropod mollusks. The species has been nearly exterminated, but in former days it appeared regularly in the Bay of Biscay in winter and migrated northward to Iceland and northern Norway in spring. On the North American coast it ranges, or did range, as far south as Georgia in winter and toward the close of that season, or in early spring, appeared in Delaware Bay and off the coast of Long Island and Massachusetts, and later in the Gulf of Saint Lawrence. A few individuals still appear quite regularly off Long Island.

There is every reason to believe that this whale was the object of pursuit of the earliest whale fishers among the Basques in the Bay of Biscay in the Middle Ages. It was the species on which the American Colonial shore whale-fishery was based. So persistently was it pursued, however, that for many years it was supposed to be extinct and no remains which could be identified with it were to be found in any museum. Within the last 25 years, a few individuals have appeared every spring off the east coast of the United States, and a few have been captured, or have stranded, on the coasts of southern Europe and Iceland. As the right whale does not occur within the tropics, it has been questioned whether the large species observed about New Zealand, in the North Pacific and in other waters is the same as that of the North Atlantic. Opinion is at present divided on the subject, but it is generally conceded that the real differences between the right whales of the northern and southern temperate seas, if any, have yet to be pointed out. The Atlantic right whale, like the bowhead, feeds upon pteropod mollusks and crustaceans.

Pygmy Right Whale of New Zealand (*Neobalæna marginata*).— This is a remarkable little whale, resembling the large right whales, but reaching a length of only about 20 feet. It has a small dorsal fin, but no abdominal ridges or furrows. The whalebone is long and white. In color the whale is black, with a line of white along the belly. It has many osteological peculiarities, among which one of the most striking is the flatness and breadth of the ribs, of which there are 17 pairs. The lumbar vertebræ are only two in number. Little is known of the habits of this whale.

Sperm Whale (*Physeter macrocephalus*).— This whale, as already stated, belongs to the *Odontoceti*, or toothed whales, one of the two main divisions of the order Cetacea, which includes also the porpoises, river-dolphins and bottlenosed or beaked whales. But one species of sperm whale is known. When full-grown the male reaches a length of 60 or 65 feet, but the female is much smaller. The head is of immense size, and is shaped like an elongated wedge with the base uppermost, and the edges and free end rounded. The blowhole is single and situated at the end of the snout on the left side. The lower jaw is very narrow and much shorter than the upper, and the two sides are joined together anteriorly for about one-half the length. In it are implanted about 44 large conical teeth which fit into pits in the upper jaw when the mouth is closed. There are no teeth in the upper jaw. The back is without a fin, but is raised into a number of low irregular humps posteriorly. The pectoral fins are broad and about six feet long. In color the sperm whale is blackish above and somewhat mottled with gray below. It occurs in all seas except the Arctic and Antarctic, but is essentially an animal of the tropics. The herds or schools are diversified in character, some comprising only young bulls; others, females and young led by an old bull, etc. At times old bulls are encountered wandering singly or in small groups. These old males are ill-tempered and pugnacious, and do not hesitate to attack the boats of the whalers. The sperm whale feeds upon large cuttlefish, which its great strength and powerful under-teeth are supposed to enable it to dislodge from their rocky retreats at the bottom of the sea.

Bottlenosed Whales, or Beaked Whales (family *Ziphiidæ*).— This family comprises four or five genera of small whales, none of them exceeding about 30 feet in length. Several species of each genus have been described, but many of them appear to be without a certain foundation. Like the sperm whale, they belong to the suborder *Odontoceti*, or the toothed whales. They never have, however, more than four teeth regularly implanted in the jaws, but some species have numerous minute rudimentary teeth imbedded in the lips. The head of all the forms, at least in the young, is pointed, the dorsal fin low and placed far back toward the flukes, the pectoral fins narrow and of moderate length. In the bottlenosed whale of the North Atlantic (*Hyperoödon rostratum*) the forehead gradually increases in size with age, until it is sharply marked off from the narrow beak, like the shoulder of a bottle. The species congregates in large herds and is eagerly sought by whalers for its oil. The beaked whales of the remaining genera *Mesoplodon*, *Berardius*, and *Ziphius*, are far less abundant. They travel in pairs. *Hyperoödon* is peculiar to the North Atlantic, *Berardius* occurs only in Bering Sea and about New Zealand, while *Mesoplodon* and *Ziphius* appear to be cosmopolitan genera. The beaked whales subsist upon cuttlefish.

Spermaceti.— Spermaceti is the solid constituent of the crude oil of the sperm whale and some other cetaceans. The head of the sperm whale, between the skull and the integuments, is a kind of large reservoir of a semi-solid "head-matter" rich in spermaceti, but the substance is also contained in the oil of other parts of the body and especially the dorsal humps. To extract the spermaceti, the oil is boiled, chilled and afterward submitted to a very heavy pressure. The crude brown spermaceti is

refined by heating and bleaching with alkali. Spermaceti is a whitish, translucent substance, a little lighter than water, and soluble in chloroform, ether and carbon bisulphid. It melts at about 125° F. Though an excellent substance for candles, it has been very largely supplanted for that purpose by paraffin and other low-priced materials. The production in the United States in 1901 amounted to 400,000 pounds, valued at $100,000.

Whalebone.— Whalebone is the outgrowth of horny substance from the epidermis of the upper jaw in whales of the family *Balænidæ*. It takes the form of triangular plates, which differ greatly in size, proportions and color in different species. Plates to the number of 200 or 300 are attached by their bases transversely to the roof of the mouth on each side. They are longest in the middle of the series and at the ends become mere bundles of fibres. The plates are smooth and straight on the outer edge, but the inner edge is fringed with coarse bristles. The bristles of adjoining plates become matted together, forming a strainer by which the whale is enabled to retain in its mouth the fish or small crustaceans, etc., on which it feeds, while the water is squeezed out through the plates by the action of the tongue. In the right whales, the humpback and the sulphurbottom, the whalebone is black or blackish; in the common finback, striped gray and white; in the pollack whale, black with white bristles; and in the little piked whale, the California gray whale and the pygmy right whale of New Zealand, yellowish-white. The most valuable whalebone commercially is that of the right whales and especially that of the bowhead, which may have a length of from 10 to 12 or even 15 feet, and is very flexible. A single bowhead yields 2,000 pounds of whalebone, valued at from $5 to $7 a pound.

Whalebone from the humpback, sulphurbottom and finback is short, coarse and brittle, but also enters into commerce. Whalebone is used in the manufacture of corsets, in stiffening and adding gloss to certain kinds of cloth, for surgical instruments, whips, etc.

Bibliography.— For American whales consult Goode, 'Fishery Industries' (10th Census, Sec. 1, Washington 1884); Scammon, 'Marine Mammals' (San Francisco 1874); Bullen, 'Cruise of the Cachalot' (New York 1900). For cetaceans in general consult Beddard, 'Book of Whales' (London and New York 1900), which contains a copious list of references to other books. An exhaustive account of the whale fishery will be found in the 'Annual Report of the United States Fish Commission for 1883,' by Temple Brown.

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WHALE-BIRD. See FULMAR.

WHALE-HEAD, a stork. See BALÆNICEPS.

WHALE-LOUSE, any of various small crustaceans parasitic on whales. (See FISH-LICE). These crustaceans have a rudimentary abdomen, and have the limbs of the first joint of the thorax or chest inserted beneath the throat. The body is flattened and of oval shape and the legs are all prehensile. They burrow deeply into the skin of their hosts.

WHALE OIL. Oil obtained from a whale's blubber by trying out. (See WHALE). It is light yellow to dark brown. The variety known as sperm oil comes from the head of the sperm whale. The use of whale oil appears to be of ancient origin. It was doubtless first obtained from whales accidentally stranded on the shores, a more frequent occurrence during the early abundance of the cetaceans than at present, when their numbers have been so greatly reduced by excessive fisheries. As the demand for the oil increased beyond the supply available from stranded whales, individuals sighted from the shore were attacked and beached. Owing to the frailty of the boats and equipment, this was a more daring attempt than might be supposed. Just prior to the Revolutionary War there were 183 American vessels in the right-whale fishery of the North Atlantic waters and 125 were engaged in cruising for sperm whales from Newfoundland to the coast of Brazil. The Revolutionary War and the War of 1812 interfered with the fisheries; but during the period of peace following 1815 they increased greatly in extent until 1846, when the fleet numbered 678 ships and barks, 35 brigs and 22 schooners, a total of 735 vessels, with an aggregate tonnage of 233,189 tons and a value of $21,075,000, exclusive of outfits and supplies. The entire capital invested in the fishery and its associated industries at that time approximated $40,000,000 and 40,000 persons derived from it their chief support. During the same year the whaling fleet of all Europe numbered but 230 vessels. Large whales have been known to yield 250 barrels of 32 gallons, but probably an average for a large whale was 75 barrels and down to 12 barrels for a small bottle-nose whale. The crude value of the American catch from 1840 to 1860 averaged about $8,000,000 annually. The greatest value was in 1854, when 2,315,924 gallons of sperm oil worth $1.48½ per gallon, 10,074,866 gallons of whale oil worth 59⅝ cents per gallon and 3,445,200 pounds of whalebone worth 39½ cents per pound were secured, the total value being $10,802,594. In the preceding year, 1853, the total product was 3,246,925 gallons of sperm oil, 8,193,591 gallons of whale oil and 5,652,300 pounds of whalebone, the whole valued at $10,766,521. Sperm oil and whale oil then served nearly all the diversified uses for which oil was required, the chief exception being leather-dressing, for which neatsfoot and cod oils were largely employed. The principal uses were as illuminant, lubricator, in cordage manufacture, screw-cutting and steel-tempering. The streets of the principal cities were lighted with the oil and theatres and public buildings were lighted with gas made from the oil settlings.

In 1902 the whaling fleet of the United States consisted of eight steamers, 18 barques and brigs and 12 schooners, aggregating 8,366 tons. Of these, 11 barques and 10 schooners were sperm-whale fishing in the Atlantic Ocean, eight steamers in the Arctic, six barques in Okhotsk Sea and off the coast of Japan, two schooners in Hudson Bay and one brig at Desolation Island. The total whale-oil product of the world in 1902 approximated 3,000,000 gallons, of which 750,000 gallons were produced by the United States fisheries, 900,000 by those of Norway and the

remainder by Scotland, Russia, Japan, Newfoundland, etc. Since that date the product has steadily reduced.

WHALEBACK STEAMSHIP. See STEAM VESSELS.

WHALEBONE. See WHALING.

WHALING, or the pursuit of whales as an industry, existed in the North Atlantic Ocean at a remote period. There are obscure references to it in Norwegian and English history as early as the beginning of the 10th century. In the 11th century the Basques pursued the North Atlantic right whale, or black whale (*Balæna glacialis*), with harpoons, in open boats. It is even asserted that they crossed the Atlantic in pursuit of their quarry before the time of Columbus, but this has not been substantiated. Certain it is that they visited Newfoundland immediately after the discovery of America and captured the same species of right whale in those waters. They are supposed also to have first seen the Arctic right whale, or bow-head (*Balæna mysticetus*), in the Strait of Belle Isle. In 1607 Henry Hudson encountered the bowhead in the vicinity of Spitzbergen. The Spitzbergen fishery developed rapidly on account of the large amount of oil yielded by this species and was extensively engaged in by various European nations, especially the Dutch, who in 1680 employed 260 vessels and about 14,000 men in the industry. During the decade beginning 1679, the Dutch took an average of about 1,000 whales annually. As the bowheads decreased about Spitzbergen, they were sought for to the westward, and in 1719 a Dutch vessel first entered Davis Strait. This fishery was developed chiefly by the British, Danes and Americans; in 1789 there were 255 British vessels engaged in it. The first American vessel visited Davis Strait in 1732. The number increased rapidly and at the height of the fishery, just before the Revolutionary War, Massachusetts alone sent 183 vessels to the strait.

About 1670, the American colonists succeeded in establishing a boat shore-fishery for the Atlantic right whale, which in those days was abundant on the coast, especially off Long Island and in Delaware Bay, and was well known from a much earlier date through stranded individuals. Later the colonists pursued the whales in sailing vessels farther from shore and in the Gulf of Saint Lawrence, but finally turned their attention to the Arctic right whale, or bowhead, in Davis Strait, as already mentioned.

About 1712 the first sperm whale was captured at sea by a Nantucket whaler. This fishery rapidly rose in importance and was pursued in all the oceans of the globe, especially by the Americans. The British did not apply themselves to it until 1775, but in 1790 a British whaling vessel rounded Cape Horn and opened up the Pacific fishery, which immediately grew to enormous proportions, and was at its height in 1837. The American whaling fleet in 1839 comprised 555 vessels, of which the majority were engaged in the Pacific sperm-whale fishery. In 1847 the number rose to 594, while the foreign whaling fleet numbered 230 vessels. The size of the American fleet reached its maximum in 1846, when 729 vessels were employed.

While a large part of the American fleet was engaged in the pursuit of the sperm whale, the remaining vessels were chiefly employed in hunting right whales, especially in the North Pacific. As the sperm-whale fishery declined, this branch increased in importance. In 1835 the famous Kadiak ground was discovered. A new epoch opened in 1843 when bowhead whales were first taken off the Kamchatka Coast. In 1848 the first vessel passed through Bering Strait to pursue these large whales in the Arctic Ocean. The fishery in the North Pacific and adjoining Arctic was at its height in 1852, when 278 vessels were employed. In 1866 the first American steam whaling-vessel was brought into use, and in 1880 two steamers were added to the Pacific-Arctic fleet.

The introduction of mineral oils for illuminating and other purposes and the decrease in the abundance of whales gradually broke down the fishery for right and sperm whales and at the present time the number of vessels engaged in the industry is negligible. A few sailing vessels still pursue the sperm whale, but in 1902 only five British vessels (steamers from Dundee, Scotland) entered Davis Strait in pursuit of the bowhead. The American whaling fleet in 1902 comprised 38 vessels, including eight steamers engaged in the Pacific-Arctic bowhead fishery. Of the remaining 30 sailing vessels, 21 engaged in sperm whaling in the Atlantic; six visited Okhotsk Sea and the coast of Japan, two entered Hudson Bay and one remained about Desolation Island. To-day (1918) there are so few that little record is kept of their activities.

The humpback whale was always pursued to some extent by right-whale whalers, but the finbacks and sulphurbottoms, besides furnishing a relatively small amount of oil, were too swift to be attacked successfully with hand-harpoons. About 1865, Svend Foyn, a Norwegian fisherman, invented a method of shooting them with a combined harpoon and bomb fired from a swivel gun mounted at the bow of a small steamer and for 30 years large numbers of sulphurbottoms, finbacks and humpbacks were killed annually at stations established on the coast of Finmark. Later the same method was employed at Iceland, The Faröe and Shetland Islands and also about Japan. In 1898 this mode of whaling was introduced into Newfoundland, where a number of sulphurbottoms, common finbacks and humpbacks are still killed annually.

A considerable number of common finbacks and humpbacks have been killed in Massachusetts Bay and the Gulf of Maine by means of explosive bombs attached to a special form of hand-harpoon, called a "darting gun." A boat-fishery of limited extent has been in existence for many years on the coast of California. It has for its object the capture of the California gray whale, and the humpback, which are killed by harpoons fired from a swivel gun mounted at the bow of a whale boat. Similar boat-fisheries exist on the coast of New Zealand, in the West Indies and in other parts of the world.

WHALLEY, hwŏl'ĭ, **Edward**, English regicide; b. England, about 1616; d. Hadley, Mass., about 1675. He was in trade, probably that of woolen-draper, at the outbreak of the

Civil War, when he enlisted for Parliament. In 1643 he became major in Cromwell's regiment of horse and in 1644 after having fought at Gainsborough and Marston Moor, appears as a lieutenant-colonel. He was made colonel of one of the two parts into which Cromwell's regiment was divided and with this force took Banbury and Worcester. Later, he was superseded. After Charles I was seized, Whalley was ordered to take charge of the king and in that post displayed much tact. He sat for Nottinghamshire in the two parliaments assembled by Cromwell, and in 1657 was made a member of the new House of Lords. He went to Scotland as agent of the army to mediate with General Monk, but had no success. On the Restoration he did not obey the summons of surrender of the king's judges and was therefore excluded from the indemnity. He sailed with William Goffe (q.v.) for New England, arrived at Boston 27 July 1660, resided for a time in Cambridge, but when the act of indemnity reached Boston in November and the town council met (February 1661) to consult regarding the refugees, went with Goffe to New Haven, where they arrived 7 March. He was associated with Goffe in the subsequent wanderings and concealments which have lent such interest to their history. Consult Stiles, 'History of Three of the Judges of Charles I' (1794); Noble, 'Lives of the Regicides' (1798); Hutchinson, 'History of Massachusetts' (3d ed. 1795); and the 'Collections' of the Massachusetts Historical Society, 3d ser. I 60, 4th ser. VIII 122. Mrs. H. M. Lothrop's romance 'The Judges' Cave' (1901) is founded on incidents in the New England career of Goffe and Whalley.

WHARTON, hwâr'tŏn, **Anne Hollingsworth,** American author: b. Southampton Furnace, Pa., 15 Dec. 1845. She has written mainly though not entirely upon colonial themes and among her books are 'The Wharton Family' (1880); 'Through Colonial Doorways' (1893); 'Colonial Days and Dames' (1894); 'A Last Century Maid' (1895); 'Martha Washington: A Biography' (1897); 'Heirlooms in Miniature' (1897); 'Salons Colonial and Republican' (1900); and 'Social Life in the Early Republic' (1902); 'An English Honeymoon' (1908); 'In Chateau Land' (1911); 'English Ancestral Homes of Noted Americans' (1915).

WHARTON, Edith (Newbold Jones), American novelist: b. New York, 1862. She was privately educated and was married to Edward Wharton in 1885. She has since resided much abroad and has published 'The Greater Inclination' (1899); 'The Touchstone' (1900); 'Crucial Instances' (1901); 'The Valley of Decision' (1902); 'Sanctuary' (1903); 'The Descent of Man' (1904); and 'The House of Mirth' (1905); 'The Fruit of the Tree' (1907); 'Artemis to Actæon' (1909); 'Tales of Men and Ghosts' (1910); 'The Reef' (1912); 'The Custom of the Country' (1913); 'Fighting France' (1915); 'Summer' (1917). In return for services rendered during the World War Mrs. Wharton was made chevalier of the Legion of Honor of France. Consult Hawthorne, H., 'Women and Other Women' (New York 1908); Underwood, J. C., 'Literature and Insurgency' (ib. 1914).

WHARTON, Francis, American jurist; b. Philadelphia, Pa., 7 March 1820; d. Washington, D. C., 21 Feb. 1889. He was graduated at Yale in 1839, studied law, and was admitted to the bar in 1843. He was professor of logic and rhetoric in Kenyon College, Ohio, 1856-63; in 1863 took orders in the Episcopal Church and became rector of Saint Paul's, Brookline, Mass. In 1866 he became a professor in the Episcopal Divinity School at Cambridge, Mass., and also held the chair of international law in the Boston Law School. In 1885 he was appointed counsel for the State Department at Washington and under a resolution of Congress (1888) was made editor of the Revolutionary diplomatic correspondence of the United States. His best known work is a 'Treatise on the Criminal Law of the United States' (1846), which is accepted as a standard and has passed through many editions. Other works of his are 'Precedents of Indictments and Pleas' (1849); a 'Treatise on Medical Jurisprudence'; 'The Conflict of Laws' (1872); 'The Law of Agency and Agents' (1876); 'Commentary on the Law of Contracts' (1882); 'Treatise on the Law of Evidence and Criminal Issues.'

WHARTON, Philip, Duke of, English politician: b. December 1698; d. Tarragona, Spain, 31 May 1731. At 16 he married clandestinely and in 1716 traveled on the Continent and visited the Pretender at Avignon. That prince, gratified by his attentions, gave him the title of Duke of Northumberland. About the end of 1716 he returned to England and thence to Ireland, where he possessed a peerage, and was allowed, although not yet 19, to take his seat in the Irish House of Peers. He obtained a British dukedom in 1718 and on attaining his majority made his appearance in the English Parliament, where he distinguished himself as the defender of Bishop Atterbury, impeached as an adherent to the House of Stuart. He also published a virulent opposition paper called *The True Briton*. He later entered the Spanish service and in 1727 served against the British at the siege of Gibraltar, for which he was in the following year attainted. His 'Life and Writings' appeared in 1732. Consult Robinson, 'Philip, Duke of Wharton' (1896).

WHARTON, Thomas, American journalist: b. Philadelphia, Pa., 1 Aug. 1859; d. there, 6 April 1896. He was graduated from the University of Pennsylvania in 1879, joined the editorial staff of the Philadelphia *Times* in 1888 and at the time of his death was Sunday editor of that journal. He published 'A Latter-Day Saint' (1884); 'Hannibal of New York' (1886). His short story 'Bobbo' enjoyed wide popularity and was republished, prefixed by a biographical sketch of the author by Owen Wister as '"Bobbo" and Other Fancies' (1897). It was dramatized and successfully played in England.

WHARTON, N. J. (formerly **Port Oram**), borough in Morris County, on the Rockaway River and on the Morris Canal, 23 miles west of Paterson and on the Delaware, Lackawanna and Western, the Central of New Jersey and the Wharton and Northern railroads. The

borough is situated in a coal-mining region, and there are blast furnaces. Manufactures include silks, paper and gunpowder. Pop. 2,983.

WHARVES AND WHARF CONSTRUCTION. The modern methods of wharf construction vary but little (except as to minor details) from the methods of the ancients. The process of constructing timber piers or wharves as practised in all of the ports of the Atlantic and Pacific seaboards is as follows: Piles of the best obtainable timber (generally pine or oak) are first driven to a solid foundation into the material forming the bottom of the harbor; these are designated as standard piles and are spaced from 6 to 10 feet from centres longitudinally and transversely (see Fig. 1), according to the desired carrying capacity of the wharf. These piles are then sawed off at the proper height above the tide level and on their tops (and fastened thereto with drift bolts) are placed timbers, often of yellow pine about 12 inches square. These timbers are known as the caps of the wharf. On these caps are placed the stringers or floor beams. They are generally four inches thick and vary from 12 to 16 inches in depth, according to the load to be sustained. They are commonly fastened to the caps of the wharf with spikes. The stringer system is placed about two feet on centres on this superstructure; the covering planks from three to six inches in thickness being fastened with the ordinary commercial spike of requisite length. After this portion of the wharf is finished nothing remains but to protect the same, either with a system of piles driven along the side used for mooring vessels (usually called fender piles and which are fastened to the superstructure of the wharf) and are sometimes additionally protected by wearing strips of timber and plank. (See Fig. 1.) A wharf projecting out from the centre longitudinally and about five feet transversely; the outer pile in each bent is cut off one foot below the grade of the balance and is capped with a longitudinal sub-cap 12 inches square. The balance of the standard piles in each bent are cut off to conform with a crown of four inches in a 60-foot wharf and are capped transversely with 12 × 12-inch timbers. The piles after being stayed into position are mortised into caps having tenons seven and one-half inches wide longitudinally with the caps, three and one-half inches thick and three inches long; the caps are also drift bolted to each standard pile with a wrought-iron bolt one inch square. (In San Francisco, the caps are merely drift-bolted to each pile with a one-inch round iron drift bolt; no tenons are used). The stringer system, or as they call it there, rangers, are 12 × 12-inch timbers, spaced five feet apart, or so as to come directly over each standard pile, the outside stringers being composed of two pieces. The covering of the wharf is of two thicknesses of four inches each. In place of fender piles, the outside standard piles are utilized for fastening vertical fenders of 8 × 12-inch white oak timbers, extending from the sub-caps to the line of low water; there are also two lines of horizontal fenders of 8 × 12-inch oak extending the entire length of the wharf (with the exception of the four outer bents); one of these is fastened to the sub-caps and the other to the backing block; between these vertical fenders there are placed intermediate fenders of the same material but reaching merely between the two longitudinal fenders. In place of mooring piles there is used a cast-iron mooring bit. The four outer bents of the wharves are spaced about 20 feet from centre to centre. They consist of a double row of piles, each row containing the same number of piles as are

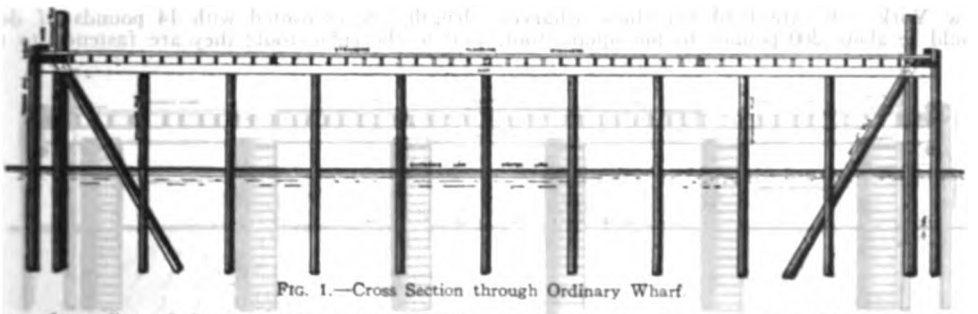


FIG. 1.—Cross Section through Ordinary Wharf

water front line of the harbor is generally reinforced or braced by means of brace or batter piles driven on both sides of the wharf (see Fig. 1) at an angle of about 35 degrees with the perpendicular and they are fastened to the outside stringer as shown. The above describes more particularly the wharves as constructed on the Pacific Coast and in use in San Francisco since 1880. These wharves are 100 feet in width and about 600 feet in length.

New York Wharves.— In New York City, in wharves of the same area, contractors use about double the number of standard or bearing piles (with the exception of the four outer bents) as were used in those of San Francisco. The piles are driven 10 feet from centre to under the regular caps, or making this row of double the carrying capacity of those caps. The end piles in each of these bents and the sheathing are so arranged that they present a rounded edge to the current. This is covered for a distance of four feet with an armature of boiler steel one-half inch in thickness and six feet in height, securely fastened to piles and sheathing. The wider spacing of the outer bent, the additional bracing and armature plates are for protection against floating ice. The timber for superstructure used there is what is known as hard yellow pine. The standard piles are generally of spruce and vary from 50 to 60 feet in length. The wharf timbers rarely exceed 30 feet in length.

Boston Wharves.— The ordinary wooden wharves of Boston are constructed as follows: Standard piles, generally of oak, are driven nine feet transversely and 10 feet longitudinally. They are bound together transversely on top with two girder caps of 6 × 10-inch hard pine and fastened to piles with one-inch screw bolts; the girder caps are let into the piles so that the same are spaced three inches apart. The outside stringers are of 10 × 12-inch and all inside stringers of 6 × 12-inch hard pine, spaced two feet from centre to centre. The wharves are covered with three-inch hard pine planks. The wharves are braced by brace piles called there spurshores; they are of oak and are shouldered against the outer standard pile at about one foot below mean high water and fastened thereto with one and one-fourth-inch screw bolts. In addition to bracing with piles, each bent has a set of crossbraces of 4 × 8-inch oak, running from a point about two feet above mean low water to the underside of the girder caps. These braces are fastened to each standard pile at each intersection with one-inch screw bolts; a horizontal tie of 4 × 8-inch oak is also placed one foot above mean low water and fastened to each pile with one-inch screw bolts. Fender piles of oak are driven in transverse lines with standard piles close up against the outer ones, and fastened thereto just below the girder cap with one and one-quarter-inch screw bolts. The fender piles are cut off nine inches below the top of the planking and are capped with 12 × 12-inch hard pine caps running longitudinally. These caps answer as longitudinal fenders and projecting three inches above the planking also as a curb or backing block. Mooring piles of oak are driven just inside of outer stringers and are held in place by four-inch planks fitted down into adjoining stringers and around mooring piles. The corners of these wharves are similarly piled and finished as are the wharves of Philadelphia and New York. A safe load for these wharves would be about 300 pounds to the square foot.

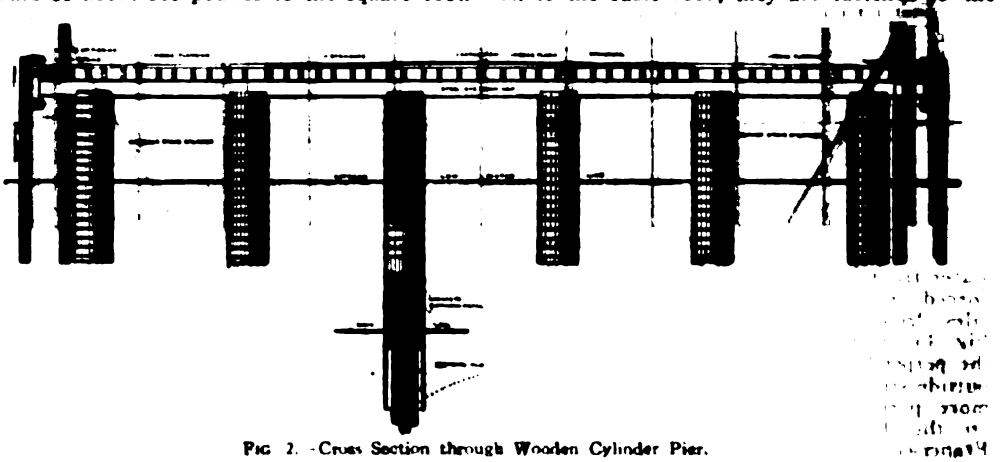
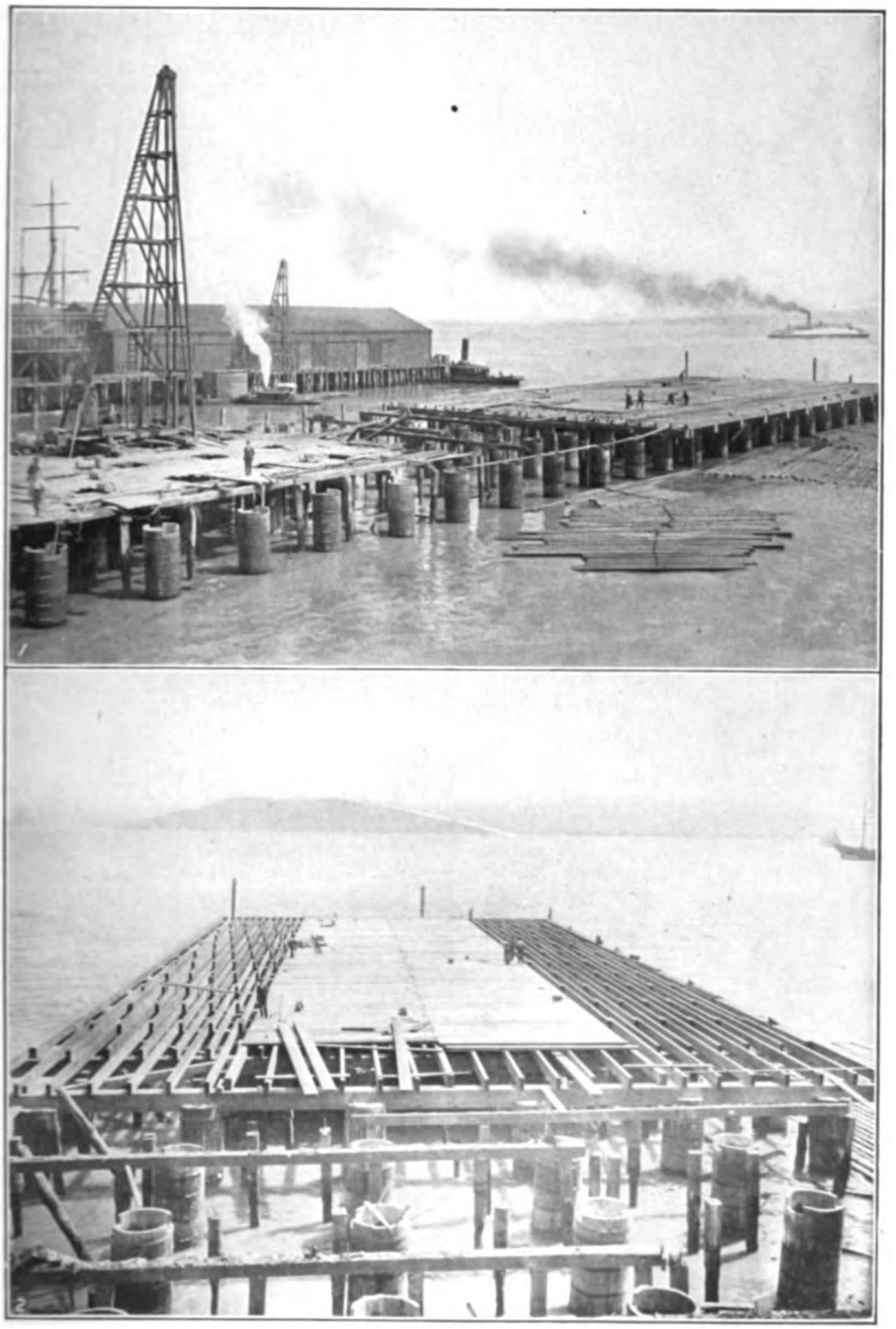


Fig 2. - Cross Section through Wooden Cylinder Pier.

Philadelphia Wharves.— These wharves, with the exception of two outer bents, are constructed as follows: Standard piles are, as prescribed by the rules of the board of port wardens, driven in bents located longitudinally, 10 feet from centre to centre. The piles in these bents are five feet apart from centres transversely and before being cut off at the proper level, they are straightened and stay lathed into position. They are then bound together transversely with girder plank of 6 × 12-inch, gained into piles, equally on each side, leaving a tenon of four inches thick, 12 inches long and the width being the full diameter of the pile. They are fastened to each pile with two screw bolts. The cap proper is a single piece 8 × 16 inches laid on flat, covering the pile and flush on each edge with the girders; they are drift-bolted to the piles and well spiked to the girder planks or clamps, as they are called. The wharf is braced in the following manner: At the line of mean low water two girders of 5 × 10 inches are fastened to each pile in each bent, one on either side of the pile; the spaces between these planks and the four outer piles on each side are chocked with 12 × 12-inch timbers securely bolted to the girder plank. The bents are then diagonally braced with "A" braces of 5 × 10 on each side, four in number, dividing the bent into two panels, that is, a set of braces extend from the girder either way from the centre of the wharf to a point at the under side of the deck line, distant from the outside of wharf one-fourth of its entire width. From the outside of wharf, at this same lower girder, another set extends to the bottom deck, and, meeting the first set, they are bolted to each pile at each intersection with galvanized screw bolts. The stringer system is composed of an outside stringer of 12 × 14 inches and intermediates of 6 × 14 inches laid two feet six inches from centres. They are gained out at caps one inch. The floor is composed of two layers of three-inch plank, dressed to a uniform thickness; the first is laid at right angles to the axis of the wharf, and the planks are placed six inches apart, these spaces over the stringers being filled solid for the full width. The planks in the outer section of this layer, about 12 feet in length, are creosoted with 14 pounds of dead oil to the cubic foot; they are fastened to the stringers with wrought spikes one-half inch square and seven inches long. The sheathing plank or upper layer are laid close and at an angle of 45 degrees with the axis of the wharf, and are spiked to the lower plank with five-inch wire nails averaging three feet apart. The

WHARF CONSTRUCTION



Views of new Howard Street Wharf, San Francisco, Cal., showing the wooden cylinder pier system of construction

backing log or curb is a 10 × 12-inch oak timber, raised above the planking of the wharf and supported on blocking of 2 × 12 inches, laid five feet apart. Fender and brace piles are used only on the outer bents. The usual system of fenders is a series of 6 × 8-inch white oak timbers placed horizontally around the wharf between the top and the line of mean low water. They are placed about six inches apart and are fastened to vertical furring pieces of 8 × 12-inch yellow pine which are bolted to the front row of standard piles in each bent, these piles being surfaced off to receive them. The two outer bents are constructed as to spacing, protection, number of piles and braces as are the New York wharves. They have rounded corners, white oak fender piles, and in addition, fender piles at the ends of these two outer bents; they have also brace piles and corner bands and chocks connecting fender piles.

Comparisons.—Comparing the construction of eastern wharves with those of San Francisco, leaving aside those parts in the eastern wharves which are designed to resist the floating ice, the details of the construction of the San Francisco wharves are simpler; having no gains or tenons, they are not so apt to suffer from dry rot; and the fact of having but few joints in caps and stringers, they are, consequently, in this respect superior to the eastern structures. However, the construction of the San Francisco wharves is better, owing to the better materials for which the coast is famous. The length of timbers for wharf construction in the east very rarely exceeds 40 feet, but generally timbers up to 30 feet in length only are specified and used. In San Francisco wharves, timbers of from 60 to 100 feet and over in length are frequently employed and are to be had with only a very small additional cost. With piles it is the same, in eastern wharf construction; a pile 60 feet long is considered a very long pile, whereas on the Pacific Coast, piles from 100 to 130 feet in length can be had at any time. The life of the superstructure of the above-described wharves, especially if covered with sheds and buildings, is from 15 to 25 years, aside from the actual wear of the planking, but in sea water the life of an unprotected pile is from six months to three years owing to the ravages of the marine pests.

Marine Pests.—The most destructive of these are the *Teredo Navalis* or ship worm and the *Limnoria Terebrans*. The *teredo navalis* is worm-shaped, being from six inches to 14 inches in length and one-fourth of an inch in diameter. It is of gelatinous nature and translucent. Its head is provided with calcareous substance or shell in two parts working on a hinge which performs the office of an auger. The head, like the body, completely fills the cavity bored and the outward appearance of the pile attacked shows no indication of the destruction going on within. Having once entered the timber it never works out nor will one cross another hole although they are sometimes less than one-thirty-second of an inch apart, or from the surface. The teredo enters the timber at the ground level and works upward, generally about two feet above low water, although it will attack floating timber; the wooden floats or buckets of a ferry steamer making half-hour trips for 18 hours at a stretch and almost constantly in motion, have been completely hollowed by the tredo. It was a theory at one time that the bark on a pile was a protection against the teredo. While this is true to a certain extent, piles taken from some of the old wharves in San Francisco Bay have been found badly eaten by these worms, the bark being otherwise intact. The *limnoria terebrans* resembles a wood louse in appearance. It is about the form and size of a grain of wheat; it works between high and low water and is very destructive. It completely destroys the pile between the tide lines avoiding all metal fastenings and knots in the wood. The borings are so close together that the wood is completely disintegrated; ends and joints of timbers seem to be the most favorable points of attack. The protection of piles and timbers from these marine pests has been the study of engineers and scientists for many years and millions have been expended on experiments with varying success. In the direct preservation of piles proper, two methods have been followed. The first and longest in use is impregnating it with chemicals that are destructive to animal life and the second is by covering the pile with an insoluble armor or artificial bark impervious to the worms.

Cresoting.—Without doubt the creosoting process is the most valuable and efficient of all processes known for prolonging the life of timber. The process was invented in England about the same time that kyanizing and the other metallic salt antiseptics came into use; it has survived all other processes and is used to a greater extent than any other method both in Europe and this country. The creosote is derived from the destructive distillation of wood and coal and consists of oil products designated as dead oil when derived from the distillation of coal or coal tar and wood creosote oil when derived from the distillation of wood or wood tar. The dead oil contains naphthaline, phenic or carbolic acid and other powerful antiseptics which change the chemical nature of the sap by forming therewith soluble compounds while the naphthaline rendered sufficiently fluid by preliminary heating, enters the wood cells, solidifies and becomes permanently fixed, mechanically coating and protecting the fibres against formation of fungi. The wood creosote contains paraffine, pyroligneous acid and other antiseptics. The advantages claimed for this oil are that its penetrating power is much greater and it is less expensive than dead oil and is equally soluble in water. The limited use of this oil seems to confirm these claimed advantages, but the matter cannot be considered conclusive until more definitely established by further experience and the test of time. All experts on preservation of timber agree that the density of timber must be favorable to impregnation; in other words, only open-pored timbers should be used for treatment with creosote, this having the least liquidity and, therefore, the hardest of all preservative chemicals to force into and thoroughly impregnate the wood. The Oregon pine or yellow fir used on the Pacific Coast is considered too dense to permit a thorough impregnation and if treated with creosote requires a longer steaming and a greater heat to extract the sap and open the pores and also a greater pressure to force the material into the wood. The consequences therefrom have been checking and cracking the timber, making it brittle

and when used for piles the process has cracked them so extensively that the limnoria were found in and behind these cracks in sheltered places in which it has done its destructive work under cover and more rapidly than when exposed to swell and current. It has also made examination of those piles more difficult, as the outer shell of the pile was apparently unattacked while the inner portion of the same was entered and destroyed by the limnoria. All authorities in writing on the preservation of piles for marine work seem to ignore the existence of the *limnoria terebrans*. In my opinion it is much more destructive on the Pacific Coast than is the teredo, and while a pile that has been thoroughly creosoted will resist the

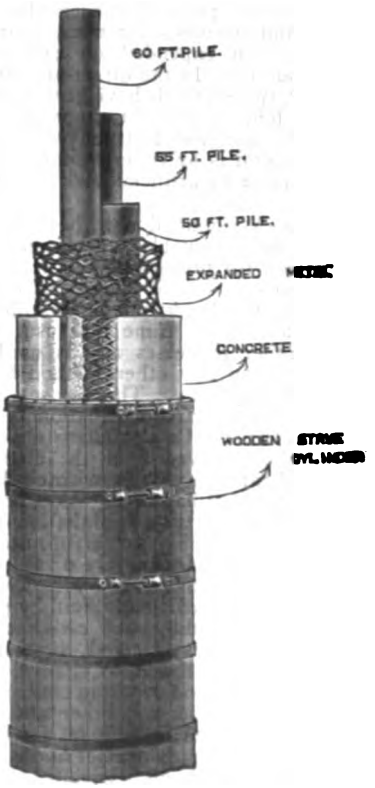


FIG. 3.—Detail of Wooden Cylinder.

teredo, even if somewhat checked, the limnoria will find the slightest opening and destroy the pile. There have been several methods for the preservation of piles in San Francisco Harbor by means of an exterior covering or artificial bark, some of which have been more or less successful, the success depending upon the durability of the covering, or, in other words, the life of the pile is the life of the artificial bark. The one making the best showing, from the fact that it has been the longest in use, is the paraffine method. It consists of a surface of paraffine paint, covered with battens which have been treated with the paint. The secret of the success of this process is the fact that it is applied cold. Previous coverings of this character having been applied hot to a wet pile, no adhesion was obtained between covering and the pile for the reason that the hot material draws the moisture to the surface. This difficulty claims to have been avoided by the parties kiln-drying the piles before covering. This process consists in covering the piles spirally with a double thickness of burlap treated with asphalt, the application or winding of the burlap being done by means of a large lathe in which the piles are turned. Another protection against these marine pests is a pile built up from a core of 6 × 6 with one-inch boards until it is 12 inches square, each layer being tarred and sanded. It is built on the theory that the teredo is loath to cross a seam and the test pile taken from section I of the seawall, a particular feeding ground of the teredo, after 10 years' immersion, verified this theory. But this was a case of again ignoring the ever active limnoria, and piles built since have shown that the limnoria found a home in the seams of the boards of which the pile was constructed. An improvement was made in the details of construction which has resulted in keeping the limnoria out and that was the placing of ship felt between the last two layers of boards from high water to two feet below low water (limnoria working only between high and low water). In many of the government piers where the teredo and limnoria are particularly active, numerous iron piles have been used, both wrought and cast. These are prohibitory in many places by reason of excessive cost of the material and construction, most of the piles having either to be screwed into the bottom or driven with a water jet. Another objection is the rapid destruction by oxidization of the joints in the bracing system.

Cylinder Construction.—A mode of construction which has been very successful on the Pacific Coast was invented by the writer and has been in use in the San Francisco Harbor for many years. It is the wooden cylinder pier construction. (See Fig. 2). The foundation proper consists of cylinders of concrete and piles placed about 15 feet on centres. The details of construction are as follows: The core consists of one or more piles, generally three; these are driven to a firm foundation and are left at different heights from the finished top of the proposed wharf, for example, say one pile is 50 feet in length, one 55 feet and one 60; this is for two reasons: first, for economy, as in the San Francisco Bay most of the piles depend absolutely on the friction of the mud for sustaining purposes (there being no known bottom) and it will readily be seen that the 50-foot piles will be as deep in the mud as the 60; secondly, it admits of a larger body of concrete at the top of the cylinder where required. After this cluster of piles is driven, there is then driven over and encircling same a wooden stave cylinder, generally four feet inside diameter; these staves are from three to four inches thick and bound together with wrought-iron hoops having adjustable lugs; these hoops are placed about two feet on centres and the cylinder is made perfectly water-tight. It is driven with an ordinary pile-driving machine from 10 to 15 feet into the mud. The water and mud in the interior is then pumped out to a depth of from two feet to five feet below the mud on the outside; then inside of this cylinder of wood, between it and the piles, is placed an interior cylinder of expanded metal or similar metallic

interstitial web about one foot less in diameter than the interior of the wooden cylinder. The interior is then filled with a rich concrete of hydraulic cement and broken rock. The cylinder pier is complete and forms a teredo-proof concrete pier, having a wooden core reinforced with an interstitial web of expanded metal and protected for at least four years with an iron bound wooden jacket. (See Fig. 3). These cylinders are then capped with caps of structural steel, generally two 15-inch I-beams and the balance of the superstructure is as in the ordinary wharf. The fender system is somewhat different from that in general use and is as follows: The fender piles are driven in pairs about 10 feet apart and about one foot away from the wharf proper; they are connected together longitudinally with a ribbing composed of three timbers both at the surface and below the top of wharf. (See Fig. 4). Between these fender piles and the outside stringer are placed a nest of heavy spiral springs similar to those used on a buffer in a freight car. This is the only direct connection between the wharf proper and the fenders; the upper ribbing at the surface of the wharf acts in the dual capacity of a curb for the wharf and a support for the fender line. This spring fender line saves the jar to both vessel and wharf and in ordinary choppy weather there is not the slightest motion to the wharf; it also saves the wear on the fender piles as these last but from one to two years, due to wear and breakage. For example, in pier No. 12, San Francisco, used by the United States transport steamers, the fender piles with the spring system have been in use seven years without a single renewal, while at pier No. 4, used by steamers of half the tonnage, all the fenders have been renewed twice in that period of time. The cylinder pier system construction has been used by the Santa Fé System, the North Shore Railroad Company and the San Francisco, Oakland and San José Railroad Company and is to be used by the Pacific Mail Steamship Company in the construction of four new piers. See HARBORS, DOCKS AND BREAKWATERS; PIER.

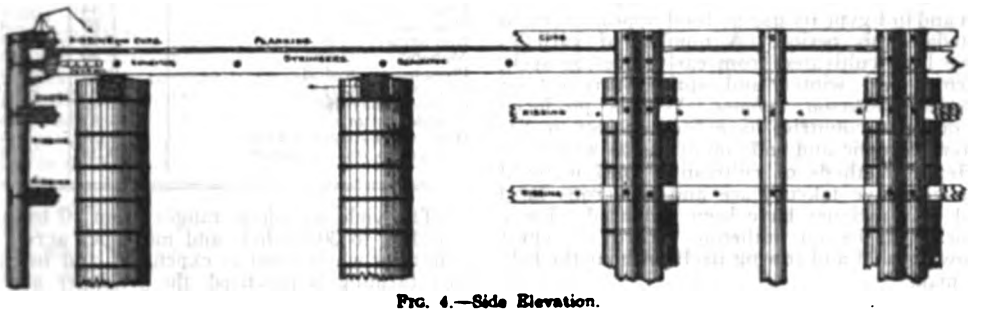


FIG. 4.—Side Elevation.

WHAT CHEER, Iowa, city in Keokuk County, on Coal Creek and on the Chicago and North Western and the Chicago, Rock Island and Pacific railroads, about 70 miles southeast of Des Moines. It is in an agricultural and coal mining region, and has several industries connected with farm and dairy products. It has six churches. The two banks have a combined capital of $80,000. Pop. 1,805

WHAT-CHEER, in Rhode Island, a watchword or shibboleth, derived from the fact that the Indians of the colony thus greeted Roger Williams and his companions, when they first landed on the Sekonk River near the present site of Providence.

WHATCOM, hwŏt'kŏm, Wash., city, former county-seat of Whatcom County. See BELLINGHAM.

WHATELY, hwăt'lĭ, **Richard**, English prelate, archbishop of Dublin: b. London, 1 Feb. 1787; d. Dublin, 8 Oct. 1863. He was educated at Oriel College, Oxford, and in 1819 made his first appearance as an author by publishing his since famous 'Historic Doubts relative to Napoleon Bonaparte.' This pamphlet is among the most popular of the author's writings, more than 12 editions of it having been published. Its object is to show that objections of the same kind as those brought forward by skeptical writers of the truth of the gospel narratives, founded on apparent inconsistencies and absurdities in these narratives, may be brought against any well-known and incontrovertible piece of history, such as that of Napoleon Bonaparte. In 1822 Whately delivered the Bampton lectures at Oxford, 'On the Use and Abuse of Party Feeling in Matters of Religion.' The same year he received the living of Halesworth in Suffolk, and was appointed principal of Saint Alban's Hall, Oxford, in 1825. In 1825 was published perhaps the most widely known of his works, 'The Elements of Logic,' and the scarcely less popular 'Elements of Rhetoric' in 1828. Whately was appointed professor of political economy in 1830. The lectures he then delivered were afterward published under the title of 'Introductory Lectures on Political Economy.' In Oxford, Whately stood in the front rank of those who held liberal views in ecclesiastical and social matters and among these his earnest love of truth, his contempt for arguments resting solely on tradition and the keeness of his logic gave him great influence. In 1831 he was appointed archbishop of Dublin and bishop of Glendalough. The cause of national education in Ireland he warmly embraced and for 20 years was an active and influential member of the board. Consult 'Life and Correspondence of R. Whately, D.D.,' by his daughter, E. J. Whately (1866).

WHEAT. Wheat belongs to the Hordeæ tribe of the Graminea or grass family. There are four principal kinds of sub-races: common wheat (*Triticum sativum vulgare*), Egyptian

and English wheat (*Triticum sativum turgidum*), flint wheat (*Triticum sativum durum*), to which the durum and macaroni varieties belong, and a dwarf variety (*Triticum sativum compactum*), supposed to have been the kind produced in ancient times. Each sub-race is in turn divided into many varieties. The wheat most generally cultivated and in most common use for bread purposes is *Triticum sativum vulgare*, although varieties of durum and spelt are extensively grown in some localities.

Wheat is of ancient origin and was cultivated by prehistoric races, as the Swiss Lake-Dwellers. In the earliest writings it is mentioned and samples which are not materially different from similar modern varieties have been found in a fair state of preservation in ancient tombs. Attempts have been made to germinate this 'mummy wheat,' but without success. The Chinese claim that wheat was used by them as food 2,700 years before the Christian era and in Egypt its use as food appears even to antedate this period. A number of varieties have been cultivated from early times, as spelt, durum, and winter and spring varieties of *Triticum sativum vulgare*. Wheats produced in different countries have been subject to different climatic and soil conditions as well as to different methods of cultivation until material changes have taken place and numerous hard and soft varieties have been produced. There appears to be no authentic record of wheat growing wild and sowing itself without the help of man.

The world's wheat crop normally amounts to about 3,750,000,000 bushels, of which the European countries produce a little more than half. At present the United States is the greatest wheat-growing country — about 850,000,000 bushels are produced annually. In 1915 the yield was about 1,000,000,000 bushels. There are large wheat areas in the northwestern possessions of British North America which have not yet been brought under full cultivation. There also are large undeveloped wheat regions in South America, particularly in the Argentine Republic, and it is claimed that some undeveloped parts of Siberia are suitable for wheat production. Thus it is evident that there are vast areas of fertile virgin soil yet to be brought under wheat cultivation.

Wheat can be grown on a variety of soils. It thrives best, however, and produces largest yields upon rich alluvium, and soils formed from different kinds of rock thoroughly disintegrated and mixed with vegetable mold. The wheat soils of the northwestern wheat region of the United States are largely of glacial formation and composed of clay and silt with small amounts of fine sand and containing liberal amounts of alkaline matter, particularly disintegrated limestone. The best wheat soils are rich in humus (decaying vegetable matter), which through decay supplies nitrogen, one of the principal elements used by the wheat plant for the formation of gluten.

The tendency in wheat farming upon new soils has been to grow the crop for a number of years without practising rotation or using fertilizers. After a time this results in reduced yields and an inferior crop, due in part to the loss of nitrogen from the land. Wheat does not remove a large amount of gross fertility from the soil, but exclusive wheat culture on virgin soil causes a rapid decay of the humus and a consequent loss of nitrogen, one of the elements of which humus is composed. When wheat is grown along with other farm crops in a good rotation and manures are intelligently used the wheat does not have an exhausting effect upon the soil. The chemical composition of a wheat soil of high productiveness from the Red River Valley of the North is as follows:

	Surface per cent	Sub soil per cent
Insoluble matter	47.64	41.21
Soluble silica	15.43	8.37
Potash	0.54	0.25
Soda	0.45	0.48
Lime	2.44	7.45
Magnesia	1.85	4.48
Iron oxide	4.18	3.48
Aluminia	7.89	10.72
Phosphoric anhydrid	0.38	0.17
Sulphuric anhydrid	0.11	0.10
Carbonic anhydrid	2.42	14.26
Volatile matter	15.55	6.22
Humus and volatile matter	5.34	0.89
Nitrogen in volatile matter	0.38	0.11

The yield of wheat ranges from 10 bushels and less to 30 bushels and more per acre. In countries where land is expensive, and intensified farming is practised, the yield per acre is generally larger than in new regions where more land is available. The yield per acre of wheat in the United States is much less than the soils are capable of producing.

Formerly plowing was done with a bent stick or wooden plow, the wheat was sown broadcast by hand, the crop was cut with the cradle and bound in sheaves by hand, and finally thrashed with the flail or by the trampling of horses. Improvements in machinery, as steam and gang plows, seeders, reapers, self-binders and thrashers, have greatly reduced the cost of production and increased the world's supply of wheat. Equally as great have been the advances in transportation, storage and milling facilities. Wheat is now transported in specially constructed freight cars and boats, and stored in large elevators in which 120,000 bushels are placed in one compartment, when formerly it was often transported on horse or mule back in bags, loaded and unloaded by hand and stored in small bins and granaries. The milling process has developed from crushing between two stones to reduction by steel rolls.

Wheat is subject to a number of diseases, as rusts, smut and other vegetable parasitic diseases, many of which have been studied and are now in part capable of being controlled. The smuts are destroyed by treating the seed wheat with chemicals which kill the smut spores, while the rusts are held in check by destroying the host plants, as the barberry, upon which the parasite spends part of its cycle of life. There are a number of insect pests which often cause great destruction of the crop, as grasshoppers, frit flies, Hessian flies and chinch bugs. Economic entomologists have done much to save the wheat crop from insect ravages.

The wheat kernel is surrounded by a seed pod composed of cellulose which constitutes the outer layer and is called the pericarp. The second covering or episperm, which is just within the pericarp, consists of the outer and inner integuments. The perisperm or third bran layer is a thin mass of collapsed cells. The aleurone layer — so-called gluten cells — is composed mainly of nitrogenous matter and lies within the three-bran layers. The endosperm of floury portion constitutes about 80 per cent of the wheat kernel and is within the three-bran layers and aleurone cells. The germ or embryo plant is stored in the lower part of the kernel where its outline can be traced by the indentations, the germ makes up about 6 per cent of the offal of the kernel, or about 1½ per cent of the entire kernel, the bran layers about 12. The relation of the different parts, one to the other, as bran to endosperm, varies in different kinds and varieties of wheat, some producing a larger amount of flour than others and some more bran.

The character of the wheat, as starchy or glutinous, is determined largely by soil and climate. A short, forcing growing season and a fertile soil have a tendency to produce glutinous wheat, while the opposite conditions produce starchy wheat. When hard glutinous seed wheat is sown in regions which produce starchy soft wheats, the hard wheat gradually changes its character and in about two years becomes starchy. Whether a wheat is hard or soft depends upon the amount and character of its gluten. Hard wheats usually contain over 12 per cent gluten, of which 45 to 65 per cent is in the form of gliadin, an alcohol soluble protein, while soft wheats contain less gluten, but gluten of a higher gliadin content.

Extensive experiments have been performed by Lawes and Gilbert of Rothamsted, England, to determine the influence which different kinds of fertilizers have upon the wheat crop. They have shown that fertilizers influence the yield more than the percentage composition of wheats and that it is not possible by means of fertilizers alone to increase materially the amount of starch or gluten. Climatic conditions affect the com- and that it is not possible by means of fertilizers Wheats grown upon the same soil in different years show greater variations in composition than wheats grown the same year but differently fertilized.

Different varieties of wheat when grown under the same conditions are fairly constant in composition. In protein content, wheats range from 7 to 18 per cent. The most nitrogenous wheats do not necessarily make the most glutenous flours, as frequently a large portion of the nitrogen is in the germ and offals.

The grading of wheat is based entirely upon the physical qualities as weight per bushel, color and plumpness. Smut and blemishes, caused by unfavorable climatic conditions, are also considered in grading wheat. When new wheat is stored in elevators, a slight fermentation change takes place known as "sweating." If the wheat is sound this change is slightly beneficial for flour production, as it improves the qualities of the flour. Unsound wheats, as those which are bleached, frosted, immature and sprouted, usually have a somewhat different composition from fully matured wheat. Such wheats may contain a larger amount of soluble proteids, soluble carbohydrates, and organic acids than normal wheats. Damaged wheats generally yield a smaller amount of flour as well as flour of poor keeping qualities.

It is not possible to make accurate comparisons as to composition of wheats grown in different countries. It will frequently be found that wheats grown in different localities of the same country vary as much in composition as do wheats grown in different countries.

Wheat contains slightly more protein and less starch than corn, oats, rye or barley. Oats from which the hulls have been removed contain more protein and fat than wheat. The difference in composition between wheat and the other cereals is not large and occasionally individual samples of corn or rye will be found containing more protein than individual samples of wheat. Wheat differs in composition from all other cereals in that its gluten is composed of the two proteids, gliadin and glutenin. This gives flour its bread-making value. It has also been found that the wheat proteins contain both different kinds and amounts of animo acids from the proteins of other curds. No other cereal except rye contains a gluten that is capable of expanding and forming a light porous loaf. Because of its unique composition no other cereal can take the place of wheat for bread-making purposes.

Numerous experiments have been made to improve the quality of wheat by selection of seed, and by breeding and crossing of standard varieties. Wheat responds readily to such tests, but unless great care is taken it as readily reverts to its original condition. In the United States two main classes of wheat are produced, namely: winter and spring wheat, of which there are a number of varieties, as white and red winter wheat, "Turkey Red," Oregon Club, Blue Stem, Scotch Fife, Marquis, etc. Minnesota, North and South Dakota, and Montana constitute the main spring wheat region; spring wheat is, however, grown in other localities.

The wheat plant assimilates its mineral food and nitrogen from the soil at a rapid rate. In the case of spring wheat, by the time the crop is half grown, over three-fourths of the mineral food and nitrogen needed for construction purposes have been taken from the soil. Wheat is not a strong feeding plant and taking its food from the soil in so comparatively short a time, the soil must be in a high state of productiveness in order to yield a good crop. The wheat plant needs greatest assistance in securing its nitrogen, hence fertilizers for wheat should be nitrogenous in character. Wheat also needs a good supply of available mineral food as phosphoric acid and potash, but is better able to secure these elements from the soil than it is nitrogen.

The flour yield of wheat is determined approximately from the size and weight of the kernels. Light weight wheat has a low flour content.

Because of its usually high price, wheat has never been extensively used as animal food, but at times when it has been cheap and abundant, it has been used for the feeding of all farm animals and has proven equally as valuable as other grains for the production of beef, pork, mutton and milk. In the feeding of wheat to farm animals, the best results are secured by

coarsely grinding or pulverizing the grain instead of feeding it whole. The main use of wheat, however, is to manufacture flour for human food. It is used more extensively as human food than any other cereal.

It has been found from extensive experiments conducted by the United States Department of Agriculture that the highest degree of digestibility and nutritive value of wheat are secured when the bran and indigestible fibre are removed from the flinty portions of the kernel. The human digestive tract is unable to digest wheat bran; animals, however, with greater digestive powers are capable of doing so. Wheat produces one of the cheapest, most nutritious and most wholesome of foods.

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WHEAT INSECT PESTS. Insects injurious to growing wheat-crops. These number from 50 to 100 different kinds in the United States alone, many of which have been imported from the Old World; and they represent a wide variety of forms and classes. The most important, probably, are flies, more or less closely related to the house fly and mosquito; and of these the Hessian fly is the most dreaded and widespread. This is a small fly (*Cecidomyia destructor*) of the family *Cecidomyidæ*, the larva of which is very destructive to wheat, barley and rye, but does not attack oats. It is named from the unfounded belief that it was brought to America from Europe (where it is native, and has been a pest for centuries) in the baggage of the Hessian mercenaries employed against the Americans in the war of independence. The female fly is about a tenth of an inch in length. Its body is brown, with the upper parts, the thorax, and the head of a darker shade, approaching to black. The wings are dusky gray, and are surrounded with fringes. The male is somewhat smaller than the female and has longer antennæ. The female flies usually lay their eggs on the young plants twice in the year, in May and September, the maggots being hatched in from four to 14 days. These work themselves in between the leaf-sheath and the stem and fix themselves near the lowest joints, often near the root, and suck the juices of the stem, so that the ear falls down at a sharp angle. These maggots turn to pupæ ("flaxseed") from which the flies develop in about 10 days; those of the fall brood hibernate in the pupa state, and are ready to begin their depredations with the early sprouting of the spring crop. In view of these habits, wherever the presence of these insects is known or suspected, the winter wheat should be planted as late as possible, or the early planting of a "trap" strip at one side of the field. In this the flies will lay their eggs, after which the strip may be plowed under and the young destroyed; volunteer wheat should be destroyed and stubble burned.

Other true flies attacking wheat and other grain-crops are mainly of the family *Oscinidæ* which contains a large number of species of variable habits, those of interest in the present connection mainly inhabiting the stems of grain and grasses. Here belongs the frit-fly of Europe, so terribly destructive both in Great Britain and on the Continent, and many species in this country whose depredations are insignificant or local or obscure. That one of most consequence, and most thoroughly studied is the "wheat bulb-worm" or "wheat stem-maggot" (*Meromyz americana*), which has been a constant evil ever since civilized agriculture began here. It is a native of the whole of North America, apparently, originally feeding on the wild grasses. In the middle latitudes of the United States three annual broods develop; there are more farther south, but only two in Canada. The life-cycle of this insect within the wheat-belt of the United States, according to Webster, is as follows: The winter is passed in the larval stage, and the short pupal stage coming in May brings the emerging of the adults at the time when the female is able to place her eggs on the plants where the young, on hatching, will make their way to the tender and succulent stem just above the upper joint. By the time the straw has ripened the larvæ have ceased to require food and pass through the pupal stage, the adults of this brood appearing in July. Eggs are now deposited in volunteer wheat and grass, and, owing either to the retarding effects of meteorological influences or a diversity of food of the larvæ or both, perhaps, the emerging of the adults is prolonged throughout a period extending from late August through September until late October. At this period the fall wheat offers a decidedly inviting plant to the female fly on which to place her eggs with a prospect of her progeny having an abundant food supply. It is the larvæ from eggs deposited during this period that winter over in the plants and give rise to the May-June generation of flies. It is this last brood that is of more especial interest to the farmer, as it is very seldom that the pest does serious injury to grain except in fall and early spring. The effect on the plant is this: in young plants the central spindle-shaped enfolded leaf is killed, the detached portion turning first yellow and later brown, then shriveling up and dying, leaving the outer lower leaves uninjured. In Hessian-fly attacks this spindle-shaped leaf is absorbed and does not appear at all in the young wheat in autumn, so that there need never be any confusion of the work of these two insects in fall wheat, and the effect on the full-grown straws is even more easily distinguishable. When attacked by the maggots of this species the fully grown straw withers at the upper joint, and all that portion of the stem including the head, the sheath excepted, changes to a whitish color, the remainder of the plant

including the upper sheath, continuing uninjured and of the usual green color. The Hessian fly never affects the full-grown straws in this manner and the lesser wheat stem-maggot (*Oscinis carbonaria*) does so but rarely, so that the presence of these maggots in the straw can be easily detected shortly prior to harvest by their whitened color from the upper joint upward. The larvæ are within the stem and not outside and under the sheath, as with the Hessian fly; they are larger and of a more glassy green color than those of the lesser wheat stem-maggot, and it is only when still very young that the ordinary farmer need ever mistake them for any of the others mentioned in this article. The liability of attack from this insect is not sufficiently great to warrant expensive preventive measures. It occasionally comes in vast numbers, but no way is yet known of foretelling these epidemics. The same precautions and methods as those taken against the Hessian fly are recommended. Several other species of *Oscinis* are known, among which the American frit-fly (*O. soror*) may prove formidable hereafter, as it has already committed extensive depredations in Minnesota. The more careful and cleanly the method of farming, the less are these and other insect pests to be dreaded.

The chinch-bug is another far too prevalent plague of grain-fields; it is, indeed, regarded as the most destructive insect in the country. It is a small blackish plant-bug (*Blissus cucopterus*), with white wing-covers each marked with a dark line like a figure 6. Arising from her winter sleep in the old grass and rubbish of the fields and fence-corners, the female lays several hundred eggs on the stems and roots of the sprouting grasses and grains near her. The young hatch quickly, and in a crowd of reddish dots suck out the juices of the growing plants, causing them to wither and die. There is another brood in the fall. Severe winters and wet and cold springs reduce the numbers of this pest, and certain diseases are known which spread among the bugs and destroy them. Infected bugs have been sent from diseased districts to other regions and imparted to the bugs there with good effect. There seems to be no preventive, however, except great care in burning stubble and rubbish, keeping the fields clean, and planting as late as possible.

Another group of highly injurious insects is found in the family *Chalcididæ* — a family of gall-flies with one genus (*Isosoma*), whose species prey upon growing plants of this kind and are called "straw-worms" or "joint-worms," because their larvæ attack the nodes or "joints" of the grain-stem. The species of special interest as affecting wheat is *I. grande* (or *I. tritici*). This gall-fly is about an eighth of an inch long and black, with a body shaped much like that of an ant and four dark wings. When, in the spring, the young wheat plants are only starting to throw the stem upward, the females (at that time minute and wingless) push their ovipositors through the stem until they penetrate the head of the embryo plant within and leave an egg there. The larva soon hatching devours this vital part of the plant and kills it, though the stem may continue to grow for some time. By the middle of June the young have developed and cut their way out to appear as the adult summer form, which wander widely. These mature, winged females now deposit eggs within the stems of wheat just above the uppermost joint, where a hardy woody gall forms about the larva, within which it transforms into the pupa stage and stays on, inert, through the winter. The best preventive measure is an annual rotation of crops; next to that, the burning of the stubble, purposely left long, but this must be done not later than early September. Various other species of *Isosoma* attack other grains, especially barley and rye, and some others also injure wheat.

Purples, ear-cockle or peppercorn is a disease of British wheat, produced by a minute nematoid worm called "wheat-eel" (*Vibrio tritici*), which are placed by their parents in the germ of the seed, and cause the formation of the purplish-black galls or "cockles" which are a feature of the disease, and in which the worms are contained. When fully grown they may attain a length of a quarter of an inch.

The Department of Agriculture has issued a large number of special illustrated publications upon the insects injurious to wheat and other grains, which should be consulted. Prominent among them are Marlatt, 'The Principal Enemies of Growing Wheat' (1901); Webster, 'Insects Attacking the Stems of Growing Wheat,' etc. (1903); Osborn, 'The Hessian Fly in the United States' (1898); Webster, 'The Chinch-bug' (1898).

WHEATEAR, or **FALLOW-CHAT** (*Saxicola œnanthe*), an European terrestrial warbler, allied to the stonechat. Its average length is six and one-half inches, and its color is gray above, the wings being tipped with black; a black streak encloses the eye and ear-coverts. The breast is brown and the under parts white. The wheatear is much sought after when in good condition as a table bird, its flesh being very delicate and is usually caught in traps. By the British peasants the wheatear's presence is regarded as a sign of ominous and unfavorable kind; and probably the fact of the nest being often found in collections of old stones in burial-places has tended to increase the superstitious feeling. The nest is buried deeply among stones or in rock-clefts, the eggs being of pale-blue color and numbering from four to six.

WHEATLAND, a famous estate and former residence of President James Buchanan, located a mile from Lancaster, Pa.

WHEATLEY, hwēt'lĭ, **Francis**, English painter: b. Wild Court, Covent Garden, London, 1747; d. London, 28 June 1801. In early life he carried off several premiums given by the Society of Arts and was employed by Mortimer in decorating the ceilings at Brocket Hall. He set up as a portrait painter at Dublin, and was much employed on small whole-lengths, among his sitters numbering many members of the Irish House of Commons. Becoming involved in a scandal he left the Irish capital for London and between 1765 and 1783 exhibited many pictures classed as "domestic," but his works also included the 'Riots of 1780,' the original of which perished in a fire, although Heath's engraving of it gives a good

idea of the work. As a contemporary of Morland he was superior to that painter in the refinement both of his subjects and his treatment of them, and was really masterly in his handling of equestrian portraits, such as 'The Second Duke of Newcastle and a Shooting Party.' He was elected R.A., in 1791. He was an important figure, being one of the founders of English rural genre, and painted pretty and graceful rustic figures of women and children, while his sense of landscape coloring was really exquisite.

WHEATLEY, Henry Benjamin, English philologist and bibliographer: b. Chelsea, 2 May 1838. He was clerk to the Royal Society (1861–79), honorary secretary to the early English Text Society (1864–72) and its treasurer (1872–1901). Besides editing for the Text Society 'The Romance of Merlin' (1865–99) and other works he is the author of 'Anagrams' (1862); 'What is an Index?' (1879); 'Samuel Pepys and the World he Lived In' (1880); 'How to Form a Library' (1886); 'London Past and Present' (1891); 'Literary Blunders' (1893); 'Historical Portraits' (1897); 'The Story of London' (1904); 'Hogarth's London' (1909), etc.

WHEATLEY, Phillis, Afro-American verse writer: b. Africa, about 1753; d. Boston, 5 Dec. 1794. She was brought to Boston in 1761, was purchased by Mrs. Wheatley, and, exhibiting a fondness for books, was instructed by her mistress and her daughters, and acquired for the time a superior education, reading Latin with facility. At an early age she began to express her thoughts in verse, and some of her poems written at 14 give evidence of poetic ability. At 19 she visited England, where she attracted much attention. A volume of her poems dedicated to the countess of Huntington was published there, containing her portrait and bearing the title, 'Poems on various Subjects, Religious and Moral, by Phillis Wheatley, Negro Servant to Mr. John Wheatley of Boston, in New England.' After return from England she published several poems, among others an address to General Washington. Her book was reprinted in Boston and passed through several editions. The family of Mr. Wheatley being broken up by death soon after her return, she married a negro named Peters, and her last days were spent in extreme want.

WHEATON, hwē'tŏn, **Frank,** American military officer: b. Providence, R. I., 8 May 1833; d. Washington, D. C., 18 June 1903. He was educated at Brown University, went to California in 1852 and studied law at Poitiers, France; lieutenant in the United States cavalry, subsequently participated in various Indian campaigns, and at the outbreak of the Civil War was promoted captain. He served with the Army of the Potomac through the war, was promoted brigadier-general of volunteers in 1862, commanded a division at Gettysburg and in the Shenandoah, and was engaged in other famous movements. He was made colonel in 1874, brigadier-general in 1892 and major-general in 1897. He was retired in the year last named.

WHEATON, Henry, American jurist: b. Providence, R. I., 27 Nov. 1785; d. Dorchester, Mass., 11 March 1848. He was graduated from Rhode Island College (now Brown University) in 1802, and studied law at Poitiers, France; he then took up the practice of law in Providence and later served as an editor and a justice; and in 1816 became reporter for the United States Supreme Court; his reports, which were published in 12 volumes, are exceptionally complete and valuable. In 1827 he was appointed chargé d'affaires to Denmark, being the first regular diplomatic agent from the United States to that country, and resided at Copenhagen until 1835, when he was appointed Minister Resident to the court of Prussia. Two years later he was made Minister Plenipotentiary by President Van Buren, which office he retained until 1846. His diplomatic work was most successful; in 1844 he negotiated a treaty with Germany, which, though rejected by the United States Senate, served as a basis for subsequent treaties. In 1843 he was elected a corresponding member of the French Institute, and in the following year a foreign member of the Royal Academy of Science of Berlin. He returned to the United States in 1847. His most important work is his 'Elements of International Law,' published in 1836, which has always been regarded as a standard authority on the subject; numerous editions have appeared in the United States, including one by Lawrence (1855) and one by Dana (1866); there is also an English edition and a French translation. His other writings include 'Digest of the Law of Maritime Captures or Prizes' (1815); 'Life of William Pinkney' (1826); 'History of the Northmen' (1831); 'Histoire du Droit du Gens en Europe, depuis la Paix de Westphalie jusqu'au Congrès de Vienne' (1841), translated into English in 1846; and 'An Inquiry into the British Claim of a Right of Search of American Vessels' (1842).

WHEATON, Loyd, American military officer: b. Pennfield, Mich., 15 July 1838. He entered the Union army at the outbreak of the Civil War with rank as sergeant and served through the war, receiving promotion to captain of volunteers in 1862, major in 1863 and lieutenant-colonel in 1864. In 1866 he was appointed captain in the regular army, was subsequently employed on frontier duty, and on the outbreak of the Spanish-American War in 1898 he was appointed brigadier-general of volunteers, was assigned to duty in the Philippines in 1899 and in 1900 received rank as major-general of volunteers. He was engaged in all the important engagements in the Philippines, and in 1900–02 was in command of the departments of North Luzon and the Northern Philippines. He was promoted brigadier- and major-general in the regular army in 1901 and in 1902 was retired.

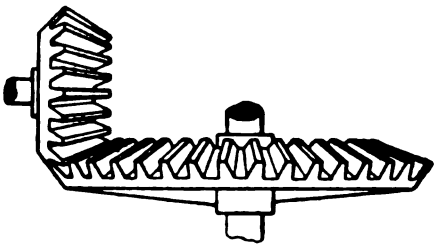
WHEATON, Ill., city, county-seat of Du Page County, on the Chicago and Northwestern Railroad, 25 miles west of Chicago. It is in an agricultural and stock-raising region. It has industrial establishments connected with farm and dairy products, and ships annually considerable hay, vegetables, wheat, flour, livestock and dairy products. The waterworks plant cost originally $60,000. The city has eight churches, Wheaton College (Congregationalist), a high school, opened in 1874, public and parish schools, a public library presented by J. Q.

WHEEL, The, a popular name for the bicycle or the bicycle trade when at the height of its prosperity, about 1900.

WHEEL AND AXLE, one of the mechanical powers consisting of a wheel mounted on an axle, with a rope or cord wound a few times around a groove in the wheel and another rope or cord turned around the axle. The wheel having the larger diameter, a small power applied at its circumference will balance a larger resistance or force on the cord around the axle, the gain in power being proportioned to the respective diameters of the wheel and the axle. The common winch, the windlass, the capstan and the treadmill are so many applications of the wheel and axle; and the same principle may be adapted to a train of wheelwork wherein motion is regulated and power acquired.

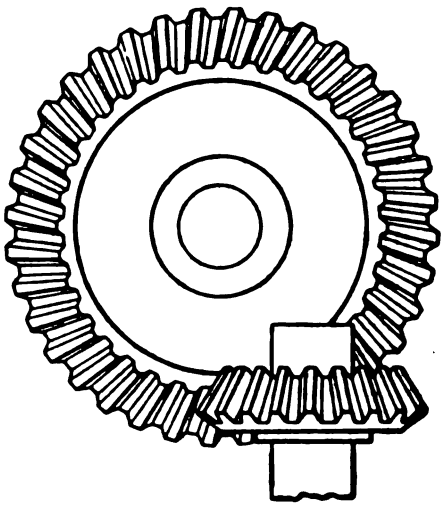
WHEEL-BUG, any of several species of conenose (q.v.).

WHEEL-GEARING, a general term applicable to all forms of mechanical devices by which motion is transmitted by means of toothed or cog wheels. The different parts of



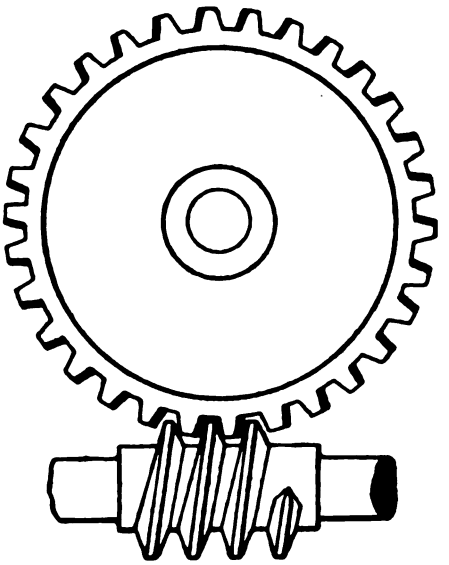
Bevel Gearing.

a machine may transmit motion to each other by "direct contact" or by means of an "intermediate connector"; in the latter case the motion of the connecting part being usually of no



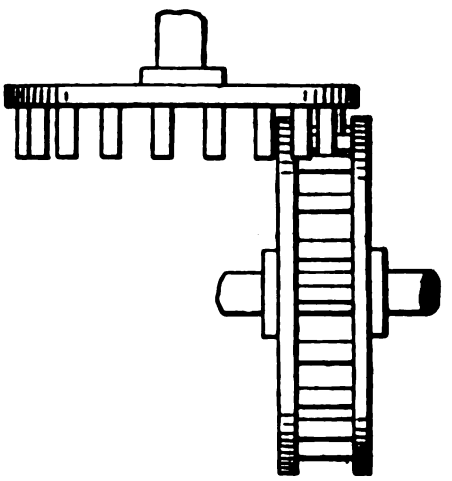
Skew Gearing.

importance since the desired object is simply the proper relative motion of the two parts thus connected. In elementary combinations of either kind, the part receiving the motion from the source of power is termed the "driver" and the part to which that motion is transmitted by the driver is termed the "follower." A train of mechanism consists of a series of such elementary combinations, the motion being transmitted to each piece from the one immediately



Screw or Worm Gearing.

preceding it, and so on throughout the entire series; therefore, in order to ascertain the action of a complete machine, the "velocity ratio" and the "directional relation" of each combination of the series has to be determined. These factors depend upon the mechanical connection of the two parts, forming the combination, and are absolutely independent of the true velocities or directions of the parts themselves, which may or may not be liable to continual variation. For example, in two circular wheels, in contact



Face Gearing.

with each other, and rotating upon fixed axles, the velocity ratio is constant. If the diameter of one is twice that of the other, the angular velocity of the larger will be one-half that of the smaller, but during any changes of velocity

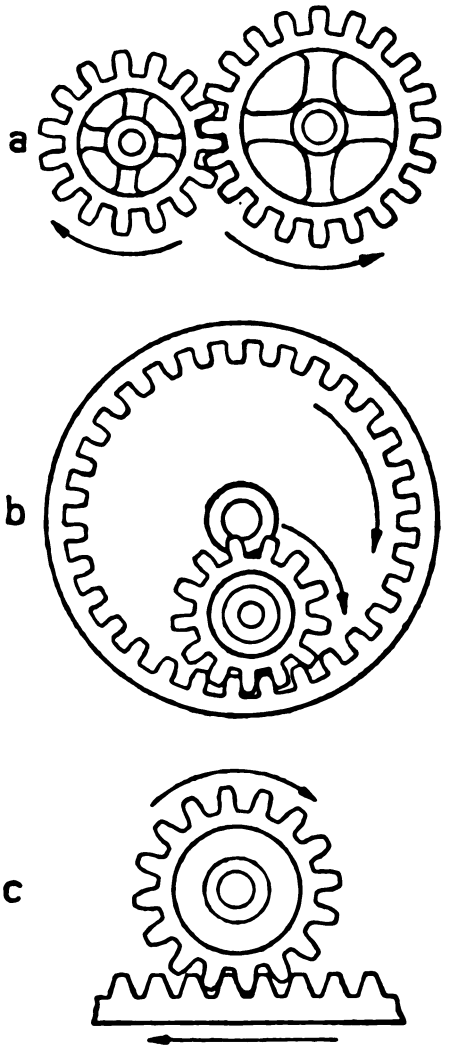
whatsoever since the length of the respective radii of the wheels remains unchanged, the velocity ratio at any instant is the same. As to the directional relation, if the wheels are in internal contact, they will rotate in the same direction, and if in external contact, in opposite directions; but in both cases the directional relations will remain unchanged regardless of any change of the absolute direction of the driver. On the other hand, if the wheels are elliptical, while the directional relation will remain constant, the velocity ratio will be subject to variation according to varying lengths of the contact radii. All elementary combinations may be divided into four classes — rolling contact, sliding contact, link work and wrapping connections. The first two are direct methods, while the two last named communicate the motion through intermediate connectors.

The theoretical forms required to transmit motion by rolling contact are cylinders, cones and hyperboloids of revolution. In the various forms of "friction gearing," employed to drive light machinery, the rolling pieces are made of different materials, one of wood and the other of iron, or one of them is covered with leather or rubber, and the necessary amount of adhesive contact is secured by adjusting the bearings of the pieces or by the application of weights or springs. It is impossible to transmit motion against any considerable amount of resistance by means of smooth surfaces, and toothed gears are, therefore, generally employed and may be conveniently divided into five classes, according to the form of the pitch or contact surfaces of the equivalent toothed wheels, and designated as "spur" gears, "bevel" gears, "skew" gears, "screw" or "worm" gears and "face" gears.

In spur gearing, the wheels act upon each other in the same plane; the pitch surfaces are cylinders and the teeth engage along straight lines parallel to the sides of the cylinders. If one is considerably smaller than the other it is usually termed the "pinion," while the larger is commonly known as the "wheel." When the teeth are formed on the inner side of the wheel, or convergent to its centre, it is called an internal wheel. Wheels in external contact rotate in opposite directions, but wheels in internal contact rotate in the same direction. As the diameter of the pitch circle of a "wheel" is increased its curvature decreases and finally becomes a straight line and results in a "rack and pinion" combination.

In bevel gearing the wheels act upon each other at an angle; the pitch surfaces are cones and the teeth engage along straight lines which pass through the common vertex of the two cones. When the angle of contact is equal to 45 degrees they are called "mitre gears." In skew gearing the axles are neither parallel nor intersecting, the pitch surfaces are hyperboloids of revolution, and the teeth engage in lines approximating to the general direction of the common element of the hyperboloids. Owing to the difficulty of constructing the teeth, this class of gearing is not much used, and where the conditions require their application, two pairs of cone wheels are generally employed.

In screw gearing the axles of the cylinders are neither parallel nor intersecting, and the pitch surfaces are in contact only at one point. In its practical form it is known as "endless screw" or "worm gear," and is commonly employed to convert rapid into slow motion. The mounting of the screw prevents any other motion except that of rotation, so that at each complete turn of the screw a tooth of the engaging wheel passes across the line of centres, and there being no limit to this action, the wheel continues to rotate so long as the screw is turned around its axis.



Spur Gearing.

(a) External Contact.
(b) Internal Contact (annular).
(c) Rack and Pinion.

In face gearing, the teeth consist of pins arranged in a circle and fastened to a flat circular plate attached to an axis. The wheels act at right angles to each other and the points of contact are situated only upon the surfaces of the pins. Prior to the introduction of bevel gears, it was the method usually employed to transmit motion between axes that were not parallel, but at the present time it is almost

exclusively used in connection with modern mill machinery.

There are a great many other forms of gearing which are adapted for various purposes. Of them the stepped, twisted, spiral and differential gearing are the most important. (For description of differential gearing see AUTOMOBILE). The particular advantage of the last-named over ordinary spur gearing is the slight friction and the consequent lack of wear of the teeth. Bevel gears of this type have been used with great advantage in mowing machines. By the substitution of epicycloidal and hypocycloidal curves and involutes for the circular arcs in the forms of the teeth, the rolling contact action of the circles, in its relation to the production of a constant velocity ratio, is replaced exactly by a sliding contact action. The teeth of all gear wheels are designed upon the principles of these curves, so that when running together their action is smooth and free from vibration and shock.

Bibliography.— For specific information relative to the application and design of gearing consult Rankine, 'Machinery and Millwork'; Grant, 'Teeth of Gears'; Kent, 'Mechanical Engineer's Pocket Book' (1903); and Stahl and Woods, 'Elementary Mechanism' (1903).

WHEEL WINDOW, *in architecture,* a circular window with radiating mullions resembling the spokes of a wheel.

WHEELER, hwē'lėr, **Andrew Carpenter,** American journalist and author: b. New York, 4 July 1835; d. Monsey, Rockland County, N. Y., 10 March 1903. He began newspaper work on the New York *Times,* and later became city editor of the Milwaukee (Wis.) *Sentinel.* Soon after the outbreak of the Civil War, he went with the Federal army as correspondent for several eastern and western papers; and afterward, following two years of incidental writing for the Chicago press, joined the New York *Leader* staff, then numbering many prominent names. For a time he wrote for the *Leader* dramatic critiques over the signature "Trinculo." Then he became dramatic and musical critic of the *World,* and began writing the articles signed "Nym Crinkle." Later still he was on the staff of the *Sun.* As "Nym Crinkle" he published 'The Chronicles of Milwaukee' (1861); 'The Toltec Cup'; 'The Primrose Path of Dalliance,' 'The Iron Trail,' and other books. Latterly, having withdrawn from journalistic work, he published under the new pseudonym "J. P. Mowbray" (or J. P. M.), two series of essays and two books of fiction — 'A Journey to Nature' (1901); 'The Making of a Country Home' (1902); 'Tangled Up in Beulah' (1902), and 'The Conquering of Kate' (1903). His authorship of these later works was not known until after his death.

WHEELER, Arthur Oliver, Canadian topographer: b. near Kilkenny, Ireland, 1860. He was educated at Ballinasloe and Dulwich colleges and in 1876 became a government land surveyor in Canada. He was later appointed Dominion topographer, and made irrigation and phototopographical surveys of Alberta near the Alaskan boundary. He also explored and surveyed the territory now known as Mount Robson Park. He is an enthusiastic mountain climber and has scaled most of the peaks of the Canadian Rockies. He was one of the organizers of the Canadian Alpine Club, and was its president in 1906–10. He edited the *Canadian Alpine Journal* in 1906–13; and is author of 'The Selkirk Range' (1903); and joint author of 'The Selkirks: a Guide for Mountain Pilgrims' (1911).

WHEELER, Benjamin Ide, American college president: b. Randolph, Mass., 15 July 1854. He was graduated from Brown University in 1875, and afterward studied for four years in Germany, traveling also in Greece. He was subsequently engaged as an instructor at Brown, Harvard and Cornell, and in 1886 was appointed professor of philology at the last-named university, receiving the chair of Greek in 1888. In 1896 he accepted the directorship of the American School of Classical Studies, at Athens, Greece, and since 1899 has been president of the University of California. He was editor of the department of philology in Johnson's 'Universal Cyclopædia' and in Macmillan's 'Dictionary of Philosophy and Psychology,' and has written 'The Greek-Noun Accent' (1885); 'Analogy and the Scope of its Influence in Language' (1887); 'Introduction to the History of Language,' joint author (1890); 'Organization of Higher Education in the United States' (1896); 'Life of Alexander the Great' (1900); 'Unterrichte und Demokratie in Amerika' (1910), etc.

WHEELER, Claude L., American physician and editor: b. Montreal, 5 March 1864; d. Brooklyn, 30 Dec. 1916. He was graduated at Laval University, Quebec, and then studied medicine at McGill University in Montreal. He engaged in the practice of medicine at Burlington, Vt., and then came to New York in 1890, where he served on the staff of the Manhattan Eye and Ear Hospital. In 1902 he became assistant editor of the *New York Medical Journal,* succeeding Dr. Frank P. Foster as editor in 1909. His publications include many brilliant discussions of medical topics.

WHEELER, Henry Lord, American chemist: b. Chicago, Ill., 14 Sept. 1867. He was graduated at Yale University in 1890 and took his Ph.D there in 1893, later specializing in chemistry at the universities of Chicago and Leipzig. Since 1908 he has been professor of chemistry at Yale University. He was elected to the National Academy of Sciences in 1909. Author of many papers dealing with organic chemistry, which have usually appeared in the *American Chemical Journal* and in the *Journal of the American Chemical Society.*

WHEELER, James Rignall, American archæologist: b. Burlington, Vt., 15 Feb. 1859; d. New York, 8 Feb. 1918. He was graduated at the University of Vermont in 1880, and received the degree of Ph.D. from Harvard University in 1885. He went to Greece during the summer while taking courses at Harvard and from 1882 to 1883 attended the American School in Athens. In 1885–86 he attended the universities of Berlin and Bonn, Germany. On his return to America he became lecturer at Johns Hopkins University and in 1886 became instructor in Greek and Latin languages at Harvard. From 1889 to 1895 he was professor of Greek in the University of Vermont, of which his father had been president. In 1894 he was elected secretary of the American School

of Classical Studies at Athens and after 1901 he served as chairman of the managing committee. In 1895 he came to Columbia University as professor of Greek, serving in that capacity until 1906, when he succeeded to the chair of archæology and Greek art. From 1906 until 1911 he was acting dean and dean of the Columbia College of Fine Arts. During those years he was also associate editor of the *American Journal of Archæology*. With Prof. Harold Fowler, he was joint-author of 'A Handbook of Greek Archæology,' and contributed various articles on archæology and philology to professional periodicals.

WHEELER, Joseph, American soldier and statesman: b. Augusta, Ga., 10 Sept. 1836; d. Brooklyn, N. Y., 25 Jan. 1906. He was graduated from the United States Military Academy in 1859; served in several scouting expeditions against Indians in Kansas and New Mexico; in February 1861, resigned his commission, and in April following was made a first lieutenant of artillery in the army of the Confederate States. In September, he became colonel of the 19th Alabama infantry. He commanded a brigade at Shiloh (6–7 April 1862), distinguished himself by his services, and was selected to command the rear guard when, at the end of the second day's fighting, the Confederates retired from the field. By reason of his success as commander of the rear guard when the Confederates withdrew from before Halleck's army (30 May 1862), and his equally successful command of the salient outpost at Corinth, led to his appointment as head of the cavalry of Bragg's army. As such he led the advance in every forward movement of the forces and commanded the rear guard with the exception of Hood's Nashville campaign (winter of 1864). In August and September 1862 he led Bragg's advance into Kentucky, and detained Buell until Bragg had captured Mumfordsville, with cannon, munitions and supplies. At Perryville (see PERRYVILLE, BATTLE OF, and THE KENTUCKY CAMPAIGN OF 1862), 8 Oct. 1862, Wheeler commanded the cavalry and displayed great energy and skill. He led a brilliant charge and captured a battery. Ordered to cover the retreat of Bragg's army, he made possible that general's successful escape, with large supply trains, to Cumberland Gap. Rosecrans on 25 December moved forward to attack Bragg before Murfreesboro. Wheeler skilfully retarded Rosecran's advance, and during the battle (31 Dec. 1862 to 3 Jan. 1863) (see STONE RIVER, or MURFREESBORO) was, in the words of Bragg's official report, "pre-eminently distinguished." He was commissioned major-general in January 1863, and in June and July took a prominent part in the battles attending Bragg's retreat to Chattanooga. At Chickamauga (19–20 September) he defeated the right flank of Rosecrans' army (20 September), penetrated to the rear, and defeated Watkins in a severe combat. On 20 September he crossed the Tennessee and captured substantially all of Rosecrans' ordnance and supply trains. He fought in the Knoxville campaign in November, and on the 27th with Cleburne, defeated Hooker at Ringgold Gap. During the spring of 1864 he aided in opposing Sherman's advance from Dalton to Atlanta, commanding the cavalry of the Confederate right wing, under Johnston and Hood. He fought almost daily, his force frequently being dismounted. On 28–31 July he defeated a Federal raiding force under Generals Stoneman, Garrard and McCook, capturing many prisoners and all the transportation and artillery. On 10 Aug. 1864 he was again in the rear of Sherman's army, capturing supplies, burning bridges and destroying railways. He went as far as the Kentucky line in eastern Tennessee, and then proceeded to northern Alabama. It was impossible, however, to arrest Sherman's advance or destroy his communications. Wheeler was then sent in advance of Sherman's army, keeping the Confederate government and commanders advised of the enemy's movements and preventing foraging parties from leaving the main force. He thus restricted the spoliation of Georgia to a comparatively narrow area. He defended Macon, Augusta and Savannah, and defeated Kilpatrick at Aiken and Johnsonville. During the operations in North Carolina in 1865, he distinguished himself at Bentonville (19–21 March) by opening an avenue for Johnston's retreat. He was promoted lieutenant-general on 28 February, and commanded Johnston's cavalry until the surrender of the Confederate armies. Subsequent to the war he studied law, and followed that profession and the occupation of a planter until 1880, when he was elected a Democratic representative in the 47th Congress. He was unseated by W. M. Lowe in 1882, but on Lowe's death not long after was re-elected, and in 1884 was returned to the 49th. He was continually re-elected, and was serving at the outbreak of the Spanish-American War. In April 1898 he volunteered for duty, and on 4 May 1898 was commissioned major-general of United States volunteers. On 14 May he was assigned to command the cavalry division, United States army, about to leave for the invasion of Cuba. He planned, and commanded in, the battle of Las Guasimas, 24 June 1898, and participated in the battle of San Juan, 1–2 July 1898. He commanded the cavalry division of the Fifth corps in Cuba from 22 June to the surrender at Santiago, 17 July. Subsequently he was in command of the troops at Montauk Point, L. I., and from 7 October to 3 December was in command of the Fourth army corps at Huntsville, Ala. From August 1899 to January 1900 he commanded the First brigade, Second division, Eighth corps, in Luzon, Philippine Islands. On 16 June 1900 he was commissioned brigadier-general, United States army, and in June-September commanded the Department of the Lakes. On 10 September he retired from the service. His publications include 'Account of the Kentucky Campaign' (1862); 'History of the Santiago Campaign' (1898); a 'History of Cuba' (1899), and eight volumes of Congressional speeches (1883–98).

WHEELER, Nathaniel, American inventor: b. Watertown, Conn., 7 Sept. 1820; d. Bridgeport, Conn., 31 Dec. 1893. He was engaged with his father in the manufacture of carriages, but about 1848 joined Allan B Wilson in manufacturing sewing machines. In 1852, on the establishment of the Wheeler and Wilson Manufacturing Company, he became its president, and by his practical knowledge of machinery and ability as an organizer soon built up what was then the largest sewing machine factory in the world. Subsequently he served for six sessions

in the Connecticut legislature; and invented and patented many improvements in sewing machines, railway cars, wood-finishing processes, etc.

WHEELER, Wayne Bidwell, American temperance worker: b. Brookfield, Ohio, 10 Nov. 1869. He was graduated at Oberlin College in 1894 and took his degree in law at the Western Reserve University in 1898. He became field secretary of the Ohio Anti-Saloon League in 1898, and superintendent of that organization in 1902. He later served on the executive committee of the national organization.

WHEELER, William Adolphus, American lexicographer: b. Leicester, Mass., 14 Nov. 1833; d. Roxbury, Mass., 28 Oct. 1874. He was graduated from Bowdoin in 1853, was engaged in teaching for several years, and subsequently assisted Joseph E. Worcester (q.v.) in the preparation of his 'Dictionary' (1856–59). He was afterward occupied with the revised edition of Webster's 'Dictionary' (1864) for which he compiled 'Explanatory and Pronouncing Vocabulary of the Names of Noted Fictitious Persons and Places, including Familiar Pseudonyms, Surnames, etc.,' which was issued separately in 1865. In 1867 he was appointed assistant superintendent of the Boston Public Library. He left unfinished an encyclopedia of Shakespearean literature and an index to anonymous literature entitled 'Who Wrote It?' The latter, completed by C. G. Wheeler, was published in 1881. He edited Hole's 'Brief Biographical Dictionary' (1866); a 'Dickens Dictionary' (1873); and also 'Familiar Allusions' (1882).

WHEELER, William Almon, American legislator: b. Malone, N. Y., 30 June 1819; d. there, 4 June 1887. He was educated at the University of Vermont and was admitted to the bar in 1845. He was United States district attorney of Franklin County in 1847–49 and in 1849 was elected as a Whig to the State assembly, but in 1856 he joined the ranks of the then newly-organized Republican party. He was a member of the New York assembly in 1858–59; in 1860 was elected to Congress; in 1867 was president of the State Constitutional Convention; was re-elected to Congress 1869 and served until 1877, taking a prominent part in the adjustment of Southern affairs under the Reconstruction Act and settling the political difficulties in Louisiana by the well-known "Wheeler Compromise." He was Vice-President of the United States under Hayes in 1877–81.

WHEELING, hwē'ling, W. Va., city, county-seat of Ohio County, on the east bank of the Ohio River, in the northern pan-handle and in the same latitude as Philadelphia, 60 miles southwest of Pittsburgh. It is on the Baltimore and Ohio Railroad, and its branch lines; the Pennsylvania System; the Wheeling and Lake Erie Railroad of the Wabash System; the Ohio River and Western Railroad and the Wheeling Terminal Railway, a belt line connecting all the roads. It is the largest and most important city in West Virginia. The land area is 2,050 acres and it has an elevation of 660 feet above sea-level. Part of the city, a beautiful residential section, is on Wheeling Island, which is over a mile long and contains 400 acres. A historic suspension bridge connects the island (the Seventh Ward) with the main part of the city, and two other steel bridges span the west channel of the river from the island to the Ohio side. Eighty miles of trolley lines in Wheeling and suburbs place a population of 75,000 in West Virginia, eastern Ohio and western Pennsylvania in connection with the city as a commercial centre. It has steamer connections with the Ohio and Kanawha river points and commands a large river trade. Among the features of interest are the courthouse and city hall combined (formerly the State Capitol), the new government building, the site of old Fort Henry, the Henry Clay monument, Wheeling and Mozart parks, Roman Catholic cathedral, Elks Home, Y. M. C. A. and Y. W. C. A. buildings, Market auditorium, Board of Trade building, the high school and the Home for the Aged. The excellent transportation facilities of the city, the large supply of natural gas piped from West Virginia and Pennsylvania fields, the extensive coal fields of the vicinity and the abundance of raw material nearby have served to make Wheeling an important manufacturing city. In 1918 Wheeling had over 200 manufacturing establishments, capitalized at $40,000,000, in which were employed 18,000 persons, receiving annual wages of $24,000,000. The yearly cost of raw material used was $38,000,000 and the finished products were valued at $75,000,000. The chief manufactures are iron and steel products, pottery, glass, tobacco, leather, lumber products, wagons and carriages. There are also print works, tanneries, packing-houses, canning factories of national reputation and the largest proprietary remedy company in the world.

Wheeling has 42 churches, embracing 13 denominations. It is the seat of the Roman Catholic diocese of Wheeling. Besides a modern public school system, including a high school, opened in 1897, there are the Linsly Institute, Mount de Chantal Academy (Roman Catholic), two business colleges, several parish schools and a public library with 40,000 volumes. Bethany College and the West Liberty State Normal School are located a few miles to the north. There are in all 51 schools, valued at $3,000,000. The city has the North Wheeling and City hospitals, two private hospitals, several orphanages, a day nursery and homes for the aged and friendless. There are 16 banks, with total clearings in 1918 of $206,985,000; four clubs occupying their own buildings, four theatres, 16 banks, four daily newspapers, a flourishing Y. M. C. A., with a commodious building, an active chamber of commerce and numerous secret and fraternal organizations. The commission form of government went into effect in 1917. The waterworks cost $1,500,000 and are maintained at a cost of $100,000 annually. The city's annual budget is about $600,000. The assessed valuation of real estate is $39,782,200. There are 30.20 miles of paved streets and 20.25 miles of paved alleys, and several miles of macadamized and graded streets. Wheeling was one of the first towns founded on the Ohio River and is supposed to have derived its name from the Wheeling or meandering character of Wheeling Creek. The first settlement was made in 1769 by Ebenezer Zane. In 1774 a stockade fort — Fort Henry, named in honor of Patrick Henry — was built here as a defense against the Indians. On 1

Sept. 1777 this fort was attacked by an Indian force of 300, who were repulsed, but 15 of the settlers were killed. In 1781 another attack was made. On 11 Sept. 1782 the fort was again besieged by a force of 40 British soldiers and 260 Indians, who continued the attack for two days, but were forced to abandon the fight. In 1769 the town was laid out by Colonel Zane and in 1795 was incorporated. In 1836 it was chartered as a city and became widely known as an important trading post on the great National Road and the Ohio River. In 1861 Wheeling was made the capital of the "restored government of Virginia" by the people of Virginia opposed to secession. It was the State capital from 1863 to 1870 and again from 1875 to 1885. Pop. 47,000.

H. P. CORCORAN,
Assistant Manager, Wheeling Chamber of Commerce.

WHEELING AND LAKE ERIE RAILWAY, The. Corporate name of a transportation company organized 14 Dec. 1916 in Ohio as successor to the Wheeling and Lake Erie Railroad Company, whose property was sold under foreclosure on 30 Oct. 1916, and purchased on behalf of the bondholders in accordance with the plan of reorganization of 20 Sept. 1916. The lines owned by the company are as follows: Main line, Toledo to Terminal Junction, Ohio, 210.05 miles; main line: Cleveland to Zanesville, Ohio, 144.20 miles; Aetnaville Extension: Terminal Junction to Aetnaville, 2.75 miles; Huron Branch: Huron Junction to Huron, Ohio, 12.80 miles; Steubenville Branch: Warrenton to Steubenville, Ohio, 13.65 miles; Sherrodsville Branch: Canton to Sherrodsville, 45.47 miles; Massillon Branch: Orrville Junction to Run Junction, 22.09 miles. Lines operated: Chagrin Falls Branch: Falls Junction to Chagrin Falls, 8.19 miles; leased line: Adena Railroad: Adena to Saint Clairsville Junction, Ohio, 20.93 miles; trackage rights: Cleveland, Cincinnati, Chicago and Saint Louis Railroad from Linndale to Wellington, 32 miles, making a grand total of 512.13 miles. In 1917 the equipment comprised 205 locomotives, 79 passenger cars, 893 box-freight cars, 80 stock cars, 7,291 coal cars, 126 flat cars and 535 service cars. The railroad moved in the same year 14,218,970 tons of revenue freight, of which 62 per cent came from mines, 27.62 per cent were manufactures and 2.05 per cent agricultural products. The average haul per ton was 106.5 miles and the average rate per ton per mile was 0.623 cents. The system carried 1,623,885 passengers in 1917, at an average rate per passenger per mile of 1.65 cents. The total operating revenue was $11,028,904, the total operating expenses $7,378,212, leaving the net revenue from operations $3,650,692. The net income was $1,113,895.

WHEELOCK, hwē'lŏk, **Eleazar,** American clergyman: b. Windham, Conn., 22 April 1711; d. Hanover, N. H., 24 April 1779. He was graduated at Yale in 1733, and from 1735 to 1770 was pastor of the Second Congregational Society in Lebanon, near Columbia, Conn. In 1754 he opened a missionary school for Indians, known from Joshua Moor, who gave for its use a building and two acres of ground, as Moor's Indian Charity School. This he removed in August 1770 to Dresden (now Hanover), N. H., founded Dartmouth College, to which a charter had been granted in 1769.

WHEELOCK, John, American educator: b. Lebanon, Conn., 28 Jan. 1754; d. Hanover, N. H., 4 April 1817. He was son of Eleazar Wheelock (q.v.). He entered Yale in 1767, but became a member of the new Dartmouth College at Hanover, N. H., and was graduated with the first class in 1771. In 1775 he was elected a member of the provincial assembly, in 1777 was appointed a major in the New York forces and soon after lieutenant-colonel in the Continental army. In 1778 he led an expedition against the Indians. In 1779 he was elected president of Dartmouth College and remained there, except two years, till 1817. He bequeathed half his large estate to Princeton Theological Seminary. He published 'Essay on the Beauties and Excellencies of Painting, Music and Poetry' (1774); 'Sketches of the History of Dartmouth College' (1816), etc.

WHEELWORK. See CLOCK.

WHEELWRIGHT, hwēl'rit, **Edmund March,** American architect: b. Roxbury, Mass., 14 March 1854; d. 16 Aug. 1912. He was graduated at Harvard University in 1876 and later studied architecture at the Massachusetts Institute of Technology and in Europe. He was afterward connected with different architects in Boston, Albany and New York, and from 1883 conducted his own business in Boston. He was senior partner in the firms Wheelwright and Haven and Wheelwright, Haven and Hoyt. He was city architect of Boston in 1891–95. He designed the Hartford Bridge, the Cambridge Bridge, the Boston Opera House, Jordan Hall at Boston, the Cleveland Museum of Fine Arts, and was one of the architects of the Boston Museum of Fine Arts. He wrote 'Municipal Architecture in Boston' (2 vols., 1898); 'School Architecture' (1901).

WHEELWRIGHT, John, American Puritan clergyman: b. Lincolnshire, England, about 1592; d. Salisbury, N. H., 15 Nov. 1679. He was a graduate of Cambridge and vicar of Bilsby, near Alford, Lincolnshire; but in 1636, being driven from his church by Archbishop Laud, he emigrated to Boston, Mass., where the same year he was chosen pastor of a branch of the Boston church at Mount Wollaston, in what is now Quincy. The celebrated Anne Hutchinson (q.v.) was his sister-in-law, and he partook of her views. Differences of opinion led to personal animosities between him and John Wilson, the pastor of the Boston church; and the General Court appointed a fast in January 1637, partly to heal these dissensions. On this occasion Wheelwright preached in Boston and, as his enemies asserted, denounced the ministers and magistrates. The General Court pronounced him guilty of sedition and contempt, for which in November 1637 he was banished from the colony. In 1638 he formed a settlement on the banks of the Piscataqua, which he called Exeter. After a residence of five years here the town was declared to be within the limits of Massachusetts, and he removed with a part of his church to Wells in the district of Maine. In 1644 his sentence of banishment was revoked, in consequence of some acknowledgments on his part, and he returned to that

colony in 1646 and settled in Hampton. In 1654 he published his 'Vindication.' About 1657 he went to England, where Cromwell, who had been his college classmate, received him cordially; but he returned in 1660 and in 1662 settled as pastor in Salisbury, N. H. His 'Writings,' with a memoir, edited by C. H. Bell, were published by the Prince Society in 1876.

WHELAN, hwē'lan, **Richard Vincent,** American Roman Catholic prelate: b. Baltimore, Md., 28 Jan. 1809; d. there, 7 July 1874. He was educated at Mount Saint Mary's College, Emmitsburg, Md., and at the Seminary of Saint Sulpice, Paris, where he was graduated in 1831. He was ordained to the priesthood in 1832, returned to the United States and in 1832–35 was a professor at Mount Saint Mary's. He was engaged in missionary work at Harper's Ferry and other towns in Virginia and Maryland in 1835–40, and in the latter year was consecrated bishop of Richmond. He built a theological seminary near Richmond, founded schools and academies, built a cathedral at Wheeling, and in various ways greatly improved the condition of his diocese. When the diocese was divided in 1850 he became bishop of Wheeling. The Wheeling diocese then contained but two churches and two priests, with no supplementary institutions of any kind. At his death it possessed 48 churches, 40 stations for religious services, 29 priests, six academies, four convents, a hospital, an orphan asylum and a college. He was present at the Vatican Council of 1869–70 and opposed the definition of the dogma of papal infallibility, considering the time inopportune.

WHELK, a gastropod mollusk of the genus *Buccinum* and order *Ctenobranchiata.* The large or common whelk (*B. undatum*) is of common occurrence on both sides of the north Atlantic, and is distinguished by the shell having its canal notched, and the mouth or aperture of large size. The whorls of the shell, which has a thick horny epidermis, are few and rounded. In England these animals are largely used for food and bait, and are caught in "creels" baited with garbage, but in America they are not eaten. The eggs are contained in egg-cases, bundles of which are common on the sea-coasts; each capsule contains several eggs, some of which develop and devour the others. The red whelk, or "roaring buckie" of the Scotch (*Fusus antiquus*), belongs to the family *Fusidæ* (q.v.). The tulip whelk (*Fasciolaria tulipa*) is very richly colored and inhabits the tropical seas. The purple whelk (*Purpura lapillus*) is so named from its affording a part of the dye which made Tyre of old so famous.

WHEN LILACS LAST IN THE DOOR-YARD BLOOMED. Swinburne called this elegy on Abraham Lincoln by Walt Whitman "the most sonorous anthem ever chanted in the church of the world." Such praise may be too high for the poem, but it can hardly be denied a place among the great elegies of the English language. The highly artistic and carefully wrought structure of the poem somewhat corresponds to that of a symphony, in its varied and intricate harmonies, and its three leading motifs of the lilacs, the evening star and the song of the thrush, which, constantly recurring, finally merge into the poet's song of love, regret and consolation. As in much of Whitman's best work, nature is here not a mere background, but is suffused with human feeling and becomes one with it. The scenes before the house in the dusk and in the swamp with the thrush, the vast panorama of country and town which loved Lincoln and which now laments him — these are not mere pictures, but realities; are not apart from the human passions of the poem, but an essential ingredient of them. The free verse, with its irregular rhythms and its lines of varying length, permits an immense range of emotional effects, of exquisite melodies and vast harmonies, perhaps not attained by any other poem in American literature; and Whitman's characteristic magic of phase weaves its spell in such lines as "the yellow gold of the gorgeous, indolent, sinking sun," and "the huge and thoughtful night." The elegy gives no such intellectual estimate of Lincoln as Lowell attempts in the 'Commemoration Ode'; it is simply a song,— a lament and a consolation. Its emotion appears as spontaneous and unstudied as it is sincere and unrestrained; but for all that the poem is none the less a nobly planned and carefully executed work of art.

MARION TUCKER.

WHERRY, hwĕr'ĭ, **William Macky,** American soldier: b. Saint Louis, Mo., 13 Sept. 1836. He was educated at the University of Missouri and studied law; served through the Civil War; and was present at the battles of Wilson's Creek, Dallas, Kenesaw Mountain, Atlanta, Jonesboro, Nashville, and at the surrender of Gen. J. E. Johnston. He was brevetted brigadier-general of volunteers in 1865, mustered out of the volunteer service in 1866, and appointed captain in the regular army and subsequently served on frontier duty. In the war with Spain in 1898 he took part in the battle of San Juan Hill and in the capture of Santiago. He was promoted brigadier-general, United States of America, 7 Jan. 1899, and was retired the same month. He has published 'Battles and Leaders of the Civil War' (1888–89).

WHERRY, a light, shallow boat, for plying on rivers; also a light, half-decked fishing vessel, used in different parts of Great Britain and Ireland.

WHETSTONE, any stone used for sharpening tools. Sandstones and fine mica schists form the coarser kinds. Silicious clay rocks and particularly the fine compact rocks made of quartz-mud, such as the Arkansas stone or novaculyte, form the more desirable varieties for oilstones and delicate hones. See SEDIMENTARY ROCKS; SCHISTS.

WHEWELL, hū'ĕl, **William,** English scholar: b. Lancaster, 24 May 1794; d. Cambridge, 6 March 1866. He was graduated from Trinity College, Cambridge, in 1816, and in due course became Fellow and tutor of his college. He labored with Herschel, Babbage and Peacock to raise the standard of mathematics in the university, and wrote textbooks which were justly celebrated. From 1828 till 1832 he was professor of mineralogy, and in 1838 was elected to the Knightbridge chair of moral philosophy, which he held till 1855. In 1841 he became master of Trinity and in this position labored earnestly and successfully to obtain for the natural and

moral sciences a better recognized position among the studies of the university. He became Fellow of the Royal Society in 1820, and was one of the first members of the British Association, of which he was president in 1841. Whewell was a strong, healthy, clear-headed man, possessed of a vigorous and capacious intellect, and endowed with extraordinary powers of acquiring and retaining knowledge. The extent and variety of his attainments were very unusual. Yet there was nothing superficial about his learning, notwithstanding the well-known *mot* of Sydney Smith, that "science was his forte and omniscience his foible." Besides other gifts, he built at his own expense, and presented to his college, a *hostel*, or collection of chambers for undergraduates. His principal writings include the Bridgewater treatise 'Astronomy and General Physics, considered with reference to Natural Theology' (1833); 'History of the Inductive Sciences' (1837); 'Philosophy of the Inductive Sciences' (1840); 'Novum Organum Renovatum'; 'Indications of the Creator'; 'History of Scientific Ideas'; 'Elements of Morality, including Polity'; 'Lectures on Systematic Morality'; 'Architectural Notes on German Churches'; 'On Liberal Education in General'; 'Lectures on the History of **Moral Philosophy** in England'; 'Philosophy of Discovery'; 'History of Moral Philosophy'; 'Platonic Dialogues for English Readers.' He was the author of the well-known anonymous essay, 'The Plurality of Worlds.' Consult Todhunter, 'Whewell: an Account of His Writings' (1876); 'Life,' by Mrs. Stair Douglas (1881); Clark, 'Old Friends at Cambridge and Elsewhere' (1900).

WHEY, a clear, straw-colored liquid, consisting of the part of milk which remains fluid after the milk has been curdled by the use of rennet in cheese making, or by the action of the acid in the natural souring of the milk. Its average percentage of solids is 6.96, of which .36 per cent is fat, .84 per cent proteins and 5.76 per cent chiefly sugar, with a trace of salts and other matter. It is ordinarily used in the feeding of swine and calves, not because of any great nutritive value but as a means of conserving economically the solids it contains. Whey cheese is made by evaporating the liquid and then adding cream. In large cheese-making establishments the whey is sometimes put through a separating process to collect the fat, which is made into a good quality of butter. Milk sugar is also made from whey in factories large enough to make it profitable. Various cooling drinks are made from whey, and in some European countries "whey cures" for certain diseases consist of drinking a prescribed amount of the liquid, and sometimes of bathing in it.

WHIGS, a word of British origin, used for many years to designate members of an American political party. It had previously been used in America in colonial and Revolutionary times to indicate those who were opposed to the attempts of the British Crown to deprive the Americans of their political and commercial rights. It disappeared with the close of the Revolution, and did not appear again until the National Republicans, successors to the Federalists (q.v.), adopted the name of Whigs. Those Whigs who considered the slavery question settled by the compromise of 1850 were called in Massachusetts "Cotton Whigs," and in New York "Silver Grays." The Whigs continued to exist as one of the two great parties until the election of 1852, which was followed by a division on the slavery issue, the anti-slavery Whigs joining the Republican party, and the others making common cause with the Democracy.

The term was prominent in British political history for nearly two centuries to designate the political party which advocates such changes in the Constitution as tend in the direction of democracy. Defoe thus accounts for the origin of the name: "The use of it began then when the western men (the peasantry of the West Lowlands of Scotland), called Cameronians, took arms frequently for their religion. Whig is a word used in those parts for a liquor (*whig*, Scotch for *whey*), which the men used to drink . . . and so became common to the people who drank it. It afterward became a denomination of the poor harassed people of that part of the country, who, being unmercifully persecuted by the government, against all law and justice, thought they had a civil right to their religious liberties, and therefore resisted the power of the prince (Charles II)." Monmouth was sent to quell the insurrection, and "at his return he found himself ill-treated for having used the rebels too mercifully; and Lauderdale told Charles, with an oath, that the duke had been so civil to the Whigs because he was a Whig himself in his heart. This made it a court word, and in a little time the friends and followers of the duke began to be called Whigs."

A different origin is, however, assigned to the term. Sir James Balfour, in writing of an outbreak which occurred in 1648, in his own day, calls the enthusiasts "whigamores," and Burnet, who was then five years old, offers the following explanation: "The southwest counties of Scotland have seldom corn enough to serve them throughout the year, and the northern parts producing more than they need, those in the west come in the summer to buy at Leith the stores that come from the north; and from a word, whiggam, used in driving their horses, all that drove were called the whigamores, and shorter, the whiggs. After the news came of Duke Hamilton's defeat (in 1648), the ministers animated their people to rise and march to Edinburgh; and they came up, marching at the head of their parishes, with an unheard-of fury, preaching and praying as they came, . . . This was called the whigamores inroad, and ever after that, all that opposed the court came in derision to be called whigs; and from Scotland the word passed to England." The Whigs brought about the Revolution of 1688–89, and established the Protestant succession; they were chiefly instrumental in obtaining the abolition of the slave-trade and slavery, the repeal of the Test and Corporation Acts, Catholic emancipation, Parliamentary and municipal reform, the repeal of the corn-laws and similar measures. The term Liberals is now generally applied to the representatives of this party; the extreme section of the party, who agitate for sweeping innovations, usually have a more or less close connection with the Whigs, and have

Communion, Chicago, 1857–59. In October 1859 he was consecrated first bishop of Minnesota. He very soon afterward organized the Seabury Mission at Faribault, out of which have since been developed the cathedral of Our Merciful Saviour, Seabury Divinity School, the Shattuck School for boys, and Saint Mary's Hall, a school for girls. Bishop Whipple was widely known as "the apostle to the Indians" on account of his labors among them both for their material as well as spiritual welfare. By the Indians he was called "Straight Tongue." He thoroughly understood the Indian character and at the time of the Sioux massacre in 1862 insisted that the trouble came directly from the false dealing of the whites with the Indians. In 1876 he secured the Sioux treaty, opening up the best portions of Dakota to white settlement, and his advice in regard to Indian affairs was sought by every President from Lincoln to McKinley. In his 'Lights and Shadows of a Long Episcopate' (1899) the character of the Indian problem will be found very fully treated. Bishop Whipple traveled extensively and was well known and highly regarded in England, while in his own country he was beloved and respected by men of every creed.

WHIPPLE, Squire, American civil engineer: b. Hardwick, Mass., 24 March 1804; d. Albany, N. Y., 15 March 1888. He was graduated from Union College in 1830 and engaged in canal and railway surveying. He patented in 1840 an iron bridge truss of the bowstring type, several of which were built over the Erie Canal. After 1852 he built several bridges known as the "Whipple trapezoidal type," and in 1872 took out a patent for a lift drawbridge, one of which was built over the Erie Canal at Utica. He wrote 'The Way to Happiness' (1847); 'Treatise on Bridge Building' (1847); and 'The Doctrine of Central Forces' (1866).

WHIPPLE, William, American soldier and politician: b. Kittery, Me., 14 Jan. 1730; d. Portsmouth, N. H., 28 Nov. 1785. Before 1751 he was captain of a merchantman trading with the West Indies and making voyages to Africa for slaves. But in 1759 he set up as a merchant at Portsmouth, and in 1775 was chosen a delegate to the New Hampshire provincial congress. He was also made a member of the provincial council of safety. In January 1776 he was elected to the Continental Congress, continuing to hold his seat until September 1779, and signing the Declaration of Independence. As brigadier-general of New Hampshire troops, he commanded a brigade in the operations against Burgoyne in 1777, and assisted in negotiating the terms of the surrender of the British general. Commanding the New Hampshire forces, he co-operated with Sullivan in the campaign against the British in Rhode Island in 1778. From 1782 to 1784 he was superintendent of finance for New Hampshire, and from 1782 until his death a judge of the Superior Court. He was president of the commission for the adjustment of the dispute between Connecticut and Pennsylvania regarding the Wyoming Valley region.

WHIPPOORWILL, a North American nightjar (*Antrostomus vociferus*). In this genus the rictal bristles are greatly developed and reach far beyond the tip of the small, weak bill, and sometimes they are fringed. The nostrils are not tubular as in *Nyctidromus*. The whippoorwill is ordinarily 10 inches long with a spread of wings of about 18 inches, the mouth bristles are simple, the tail long and rounded, and the soft lax plumage closely and delicately mottled with gray, black, white and yellowish brown, the female with the tips of the outer tail-feathers tawny, the same parts in the male white. These birds inhabit the United States and British provinces east of the plains, and breed chiefly northward, throughout most of this area. Being migratory, they reach the Middle and New England States in May. The whippoorwills are strictly nocturnal, but usually become quiet by midnight, except on moonlight nights when they continue active till dawn; but at all times they are most vociferous during the early evening. The song is a clear, energetic whistle, aptly syllabified in the name, strongly accented on the last syllable, and is repeated many times; then, after a short pause begins anew. They fly noiselessly in pursuit of flying insects, skimming low over stone walls and bushes, or even alighting on the ground to pick up an insect. Large moths, nightflying beetles and insects frequenting forest borders are their chief food. When they pass close to a person at night they may be heard to utter a low murmuring sound. Unlike the great majority of birds they always perch along and not across a bough, a peculiarity which they share with other weak-footed birds. Whippoorwills do not fly abroad during cloudy days like the night hawk, and as a consequence their appearance is unknown to many persons to whom the song is quite familiar. No nest is made, and the two elliptical, creamy white eggs, marked with brown and lavender, are laid in a depression on the bare ground, or a log. When danger threatens the old birds often carry the eggs or young in their mouth to a place of safety. A much larger species of similar colors and habits, but more southern in its range, is the chuck-will's-widow (*A. carolinensis*). (q.v.). In this species the rictal bristles are provided with lateral filaments.

WHIPTAIL SCORPION. See SCORPION.

WHIRLIGIG BEETLE. See WATER-BEETLES.

WHIRLPOOL, a circular eddy or whirling current in a stream or the sea, of considerable dimensions, produced by the configuration of the channel, by meeting currents, by winds meeting tides, etc. There are some very celebrated whirlpools, such as Charybdis, in the strait between Sicily and Italy; and the Malström, off the coast of Norway. When the agitation is increased by high tides or winds they sometimes become dangerous to navigators. But large modern vessels cannot be sucked into any whirlpool, like some of the small craft of the ancients.

WHIRLWIND. See CYCLONE; WATERSPOUT.

WHISKY, the name applied to a well-known liquor distilled from corn, barley, wheat, oats and other grains; potatoes, beet and other roots and sometimes molasses and subsequently refined, colored and flavored by various processes. However under regulations under the

Federal Food and Drug Act the name whisky alone is limited to grain distillates. Whisky from malt alone is made in the Scotch distilleries as follows: The malt is bruised upon cylinders and the quantity intended to be mashed is put into the mash pan, water at a temperature of about 170° F. being then added. After two or three hours' agitation the whole is left to repose for an hour and a half, and then the worts are drawn off to about one-third of the water employed. About two-thirds of the first quantity of water of a somewhat higher temperature is put into the pan, and the agitation is renewed for about half an hour. After a second period of repose these second worts are drawn off. Both infusions are now cooled down as quickly as possible to the temperature of 80° or 70° to prevent souring; the wort is cooled down by being exposed in shallow coolers to currents of air, or by being passed through serpentine tubes surrounded with cold water. More water may be let into the pan, and a third wort drawn off, which may be fixed with the other worts, or used instead of water for the first infusion of malt. The quantity of saccharine matter converted into alcohol depends upon the proportion of ferment or yeast introduced into the worts; if too little be used, a portion of the sugar will remain undecomposed; if too much, the spirits will have an unpleasant taste. Generally the worts are let down at the specific gravity of 1.050 or 1.060, and at a temperature of 60° to 50°. For every 100 gallons a gallon of good porter yeast is added and thoroughly incorporated by agitation. An hour after the addition of the yeast fermentation begins to show itself by a ring of froth around the edges of the vat, and in about five hours frothy bubbles cover its whole surface. Large vats generally afford a better result than small ones, owing to the equality of the fermenting process. It is considered good worts when the specific gravity comes down to that of water and superior worts when it falls to 0.995. In about 48 to 60 hours the wash begins to get clear and comparatively tranquil, and is then ready for distillation. In its simplest form the still consists of a copper boiler into which the wash is poured. This vessel is furnished with a close head terminating in a bent tube which passes in a spiral form through a vessel filled with cold water. (See DISTILLATION). On the application of heat to the still the spirit begins to rise in vapor at 175°, along with more or less steam. These vapors are condensed in passing through the spiral tube, and trickle in fluid form into a receiver. The product of this first distillation is called low wines. This is again distilled at a lower temperature, which gets rid of part of the water and of the fetid oils that had come over with the alcohol Great purity and strength can only be obtained by repeated distillation. The casks or packages into which these spirits are put are never charred, as in America, but preference is given to empty wine or rum casks which impart both flavor and color, and when plain casks are used, flavoring and coloring is accomplished by means of blending wines. If nothing whatever is added to the spirits which are put in plain casks, the coloring and flavoring is attributable to the tannic acid extracted from the wood, and the oxidation of the aldehydes in combination with the ethyl alcohol.

In the United States, Kentucky, Maryland and Pennsylvania whiskies, or those represented to be such, constitute the majority of those consumed for drinking purposes, either medicinal or otherwise. Kentucky whiskies are known as Sour Mash, Sweet Mash and Bourbons and Pennsylvania and Maryland whiskies as Eastern Ryes. At the head of the various processes of distillation, for excellence of quality of the spirit produced thereby, stands that known as "fire copper," which is the method that originally established the high reputation of whisky in these States; those since employed, while giving a larger yield of spirit to the bushel of grain, procure it at the expense of the quality and flavor thereof. In this process the corn and rye meals are scalded or mashed, with hot spent beer, which is the liquid residue of the previous distillation. The mash is then allowed to cool to the proper temperature, when malt is added, and the mash, diluted with a sufficient quantity of water, is left to ferment the time established by law. The diluted mash when fermented is called beer. The beer is distilled in three different ways. In the very smallest distilleries, it is sometimes boiled in copper stills, over wood fires; the vapor, passing through a copper coil or worm, immersed in cold water, is condensed and delivered into a receiver. The condensed liquid is called low wines or singlings. Singlings contain only a small amount of spirit. This manner of boiling the beer is seldom used, as the large quantity of grain contained in the beer makes it apt to cake in the still; and, becoming scorched, it gives the whisky a strong, smoky flavor, a very little of which, however, is not considered objectionable. The singlings are doubled or again distilled in small copper stills, or doublers, over wood fires and the vapor again condensed in a copper worm, whence it is delivered into the receiving cistern. Another name for doublings is high wines. The usual way of distilling sour mash whisky is to boil the beer in a wooden still by admitting steam, the vapor being condensed into singlings; the singlings are doubled as above. In the third way the beer is boiled in a copper still by steam confined in a copper pipe placed inside the still. The singlings are doubled in small copper stills, over wood fires, in the same manner described. This latter way is considered a great improvement, as it avoids both the scorching of the grain in distilling the beer and the admission of live steam, while it preserves all the characteristics so highly prized in "sour-mash, fire copper" whiskies. The yield by the sour-mash process is from two to three gallons to the bushel of grain.

Most whisky is made by the process known as "steam." In this the corn and rye meals and malt are mixed with water in the mash-tub, where they are scalded with direct or live steam, introduced by means of a perforated pipe at the bottom of the tub. When fully scalded the mash is cooled down and run into the fermenting tubs. Fresh yeast is used in fermenting, which gives the name of "sweet mash." The still is made of wood and divided into two or three compartments. When the still is charged a certain amount of beer is placed in each compartment, live steam is admitted into the lower, which boils the beer, and the vapor from it ascends through a curved pipe into the

compartment above, where its continued reception boils the charge therein contained; the vapor from this again ascends into the next compartment above, where the same process is repeated. The vapor then passes through a pipe into a wooden doubler, where it boils the low wines; and the vapor arising thence passes into a copper worm, where it is condensed and then run into the whisky cistern. Only one worm is used and one condensation made. Highwines, as well as whisky, are manufactured by this process. The yield is from three and a half to four and a half gallons. In making whisky by the "steam copper" process, the mash is made and fermented and the beer boiled in the same manner as for the "steam" process. The same wooden still is used; but, instead of the vapor from the upper compartment passing directly into a wooden doubler, it is run through a worm and condensed into singlings, which are doubled in a copper still by live steam, or by steam confined in a jacket around the still, or sometimes by fire underneath.

In locating a distillery a full supply of clear, bright water that contains the proper chemical qualities is the first consideration. It is well known to both chemists and practical distillers that water containing a large quantity of sulphate of lime, earthy carbonates and no organic matter is best adapted to distilling. The lime and carbonates being dissolved in the acid generated during the fermentation of the mash mostly pass off in the form of carbonic acid gas and leave the water soft and best suited for extracting the active properties of the malt and grain. Great care has to be taken in the selection of the grain to have it well developed and sound. Musty or unsound grain is fatal to the production of fine whisky, and its defects become more prominent as the whisky increases in age. Those distillers most careful to manufacture only fine goods use the grain that is grown in their own section of the country in order to have both the grain and water spring from the same kind of soil. Successful fermentation requires of the distiller not only constant attention, but also extensive knowledge both of the principles of chemistry and of practical results. It is exceedingly injurious to allow the fermentation to be prematurely concluded or to proceed too long. As a general rule, the slower the fermentation and lower the heat at which the distillation is carried on the finer and purer will be the spirit. The mash being made and fermented, and the beer distilled by whatever process, the whisky is collected in the cistern and thence run into barrels, under the control of the United States inspector, and in the custody of the United States storekeeper, who has also charge of it while in the bonded warehouse, till the tax is paid. Barrels, and the cooperage thereof, require much attention, and must be made of well-seasoned oak. For highwines they are not charred, but for whisky they should be well charred, as the char has some peculiar chemical effect on the character and ripening of the whisky that is very desirable.

The subsequent purity of the product depends largely upon the care exercised by the distiller in stopping the distillation when the temperature of the vapor rises above the boiling point of ethyl alcohol and water and certain flavoring bodies depending upon the material employed.

The process of fermentation which precedes that of distillation produces a number of alcohols radically different from ethyl alcohol (which, with water, is the body of whiskies) and which seriously serve to contaminate the product. These are usually referred to by the distiller in America as the "heads" and "tails," because the former have a lower boiling point than that of ethyl alcohol, and the latter a higher boiling point, as a result of which a careful distiller can separate them from the main body of the distillate which is to be preserved.

In England these heads and tails are called "feints." Among these is fusel oil, from which it is very desirable that the spirit should be freed as much as possible. This may be partially accomplished by the action of charcoal and heat, which are the principles underlying the barrel-charring process of refination and maturation. If, however, the fusel oil contents are too large to start with, they will never be sufficiently reduced by such process to make the product wholesome and palatable. In such case, they can only be removed or reduced by a subsequent process of rectification, including redistilling and the passage of the spirits through leach tubs. It follows, therefore, from the process of manufacture, that the fusel oil contents or percentage of impurities is not fixed or constant, and this fact led to the process called blending. Under the present system of Internal Revenue Laws in the United States distilled spirits can be sold only by one who qualifies thereunder as a wholesale liquor dealer, and such person may also be a rectifier. A rectifier is one who rectifies, purifies or refines distilled spirits, or who merely mixes without refining. Whenever it is found that whisky which has been subjected to the barrel-charring process still contains an excessive quantity of fusel oil, or has acquired an excessive quantity of tannic acid, it can only be corrected by redistillation or other rectifying processes or by the addition thereto of ethyl alcohol and water (termed for commercial purposes either "neutral spirits" or "cologne spirits") which contains no fusel oil and no tannic acid. One effect of charring a barrel is to produce a coating of a gummy, resinous substance beneath the char and next to the hard wood which is classed as caramel and which not only imparts a flavor, but produces about two-thirds of the color usually obtained by spirits which have been stored in such a barrel for a length of time. The other one-third of the color is imparted by the tannin or flavescin which the spirits extract from the wood.

Since neutral spirits are seldom put in charred barrels, they retain their original color, which is water white, and when they are mixed with the whisky which has been colored, it necessarily lightens the color which has to be restored by the addition of plain caramel. Harmless flavorings are sometimes added to modify or soften the effect of the tannin, which is a severe astringent. On account of their diminished toxicity, smoothness which sometimes results from the addition of sugar, and improved flavor which results from diluting or diminishing the tannic acid, acetic acid and fusel oil, blends are considered by some more desirable than a simple whisky.

The bulk of the so-called straight or simple

States and Canada. Generally it is found in thicket-like young woods, growing in damp rocky soil. The flowers are in long axillary racemes, and bloom late in spring, drooping under the branches. They are succeeded by strings of the two-celled winged fruits of a yellowish green tint. The slender trunks are olive-green, when older becoming a reddish-brown, striped with short, delicate streaks of white pigment, which may be scraped off, and for this reason the tree is often called striped maple; it is, however, also known as moose-wood, since the deer are fond of the young shoots when the sugary sap is flowing. The bark is easily stripped off the young branches, leaving white withes from which country folk make whistles. Other whistles are made from the bass-wood (*Tilia americana*), and the name is given in Great Britain to the mountain-ash (*Sorbus*) and to the common and sycamore maples.

WHISTLER, hwis'lėr, **James Abbott McNeill,** American artist: b. Lowell, Mass., 10 July 1834; d. London, 17 July 1903. In 1851 he was appointed to the West Point Military Academy, which he left in 1854; and in 1854–55 was a draughtsman in the Coast and Geodetic Survey. This employment he soon quitted, going to England and thence to Paris, where in 1855–57 he was a pupil in the studio of C. G. Gleyre, an artist of Ingres' school, who "never drew a line without having first assured himself how Raphael would have proceeded." Previous to the series generally styled the "French Set," Whistler is known to have etched three plates, and other early attempts were made. The "French Set," renderings of figures, street scenes and interiors, appeared in 1858 (published by Delâtre) — 12 plates, with an etched title. But few copies were printed. In 1863 Whistler went to London and settled in Chelsea. During his earlier days there he completed the 'Thames Set' of etchings, 16 in all, treating of the craft of that stream and the quaint buildings along its edge. Some rare prints of these, generally considered superior, were made before their publication in 1871. 'The Pool' and 'Black Lion Wharf' are among the best of them. He exhibited paintings frequently at the Royal Academy, one of the earliest being 'At the Piano,' purchased by the Scottish painter John Phillip for 30 guineas. In 1872 the 'Arrangement in Gray and Black' ('The Painter's Mother'), now in the Luxembourg Gallery, was accepted by the Academy only on the insistence of Sir William Boxall. Whistler sent other pictures, such as 'The Last of Old Westminster,' and 'Symphony in White III,' but he could not agree with the management of that institution, long before his death ceased to exhibit there and was never made A.R.A. Some of his best work was shown at the Grosvenor Gallery, opened by Sir Coutts Lindsay in 1877, including famous portraits, 'Irving as Philip II' and the 'Arrangements,' 'Harmonies,' and 'Nocturne,' novel in title and character. It was in 1877 that Ruskin wrote of the 'Nocturne, Black and Gold' ('The Falling Rocket'), then at the Grosvenor: "I have seen and heard much of cockney impudence before now, but never expected to hear a coxcomb ask 200 guineas for flinging a pot of paint in the public's face" ('Fors Clavigera'). Then ensued the diverting Ruskin suit, brought for libel by the artist and heard in November 1878. The verdict was for the plaintiff, and the farthing assessed for damages Whistler afterward wore on his watch chain. The costs against Ruskin, £306 12s. 4d., were met by a public subscription. Whistler followed up the affair by his pamphlet, 'Art vs. Art-Critics,' in which he first proved his cleverness in controversial satire. He preferred to exhibit his works under conditions which he could himself direct and gave a special exhibition in 1874. Others, of either prints or paintings, were held in the rooms of the Fine Arts Society in 1880, 1881, 1883, 1884 and 1886. At the International Society, Knightsbridge, he always had chief place. He became a member of the Royal Society of British Artists in 1884 and in 1886 some "revolutionary members" made him its president. His administration improved the artistic quality of the exhibitions, but was not commercially successful, and in 1889 he failed of re-election and many of his following resigned. His explanation was characteristic: "It is all very simple. The Royal Society of British Artists has disintegrated — the 'artists' have come out, the 'British remain.'" He failed for a long time of the recognition he merited; but latterly many distinctions were conferred upon him. He was a member of the Legion of Honor and the Bavarian Order of Saint Michael, member of the Munich, Rome, Dresden and other academies; in 1900 received the unusual award at the Paris Exposition of the gold medal for etching and also for painting; and in 1902 the gold medal of honor from the Pennsylvania Academy of Fine Arts. By many Whistler's etchings have been ranked as the consummate product of his art, classed with those of Rembrandt and even said to surpass the world's greatest etcher in the process of selecting essentials and a certain subtlety in execution. He did not keep a set of proofs or memoranda of his work and probably no complete list of his etchings. The first catalogue of them appeared in 1874. Wedmore gave 214 in 1880, 268 in 1889; a supplement to Wedmore increased the number to 372. It is probable that the total is more than 400 prints. It has been said that while Rembrandt chose greater subjects, only a comparatively small part of the total number of his plates is sought by collectors, but all of Whistler's are highly esteemed by connoisseurs. "There are no failures," declares one writer; some are sketchier than others, but all are genuine expressions of Whistler's art. Whistler used an increasing economy of means; the 'First Venice Set,' published by the Fine Arts Society in 1880 (12 plates), and the 'Twenty-six Etchings' (1886), principally of Venetian subjects, though including some English also, show in this respect great difference from the 'French' and 'Thames' sets. The unfailing characteristics of the etchings are precision and flexibility of line and remarkable picturesqueness in the rendering of shade and light. Their observation and their technical skill are alike noteworthy. Of the single plates may be mentioned 'Joe,' 'Little Putney,' 'Battersea Bridge,' 'Old Chelsea' and 'Speke Hall.' Examples are to be seen in many important

public collections, including the Venice Academy, Bibliothèque Nationale, British Museum, the New York Public Library and the Dresden Gallery. In dry-point and lithography, too, Whistler was very successful. His first lithographs were made in 1877 and he greatly improved the art. His London exhibition of 1883 contained, besides etchings, a number of dry-points; in 1896 about 70 lithographs were shown at the Fine Arts Society. The Way catalogue, no longer in print and claiming to include all those printed down to 1897, gave 130, to which at least eight must further be added. The list of nearly 400 etchings and dry-points and 138 lithographs, known to be in existence, reveals a large amount of work, even supposing that the artist had done nothing else. In pastel and water-colors, Whistler wrought sparingly, although some of the Venetian pastels are the equals of anything yet attempted in that medium. His creed as a painter he stated in two series of 'Propositions,' and the lecture 'Ten o'Clock' first given in London 20 Feb. 1885. One of the propositions was that a painting had "no mission to fulfil," but was a "joy to the artist, a delusion to the philanthropist, a puzzle to the botanist." Critics he thought a herd of ignoramuses; but they had their utility — "they keep one always busy, always up to the mark, either fighting or proving them idiots." For a long time in London he was better known for his pugnacity than for his art. His arrogance, his mordant wit, his sparkling bon-mots, his striking individuality — these were sooner recognized than his genius. His fondness for sarcasm and the severity and clearness with which he lambasted those he did not like — and they were many — qualified him as a past-master in "the gentle art of making enemies." It is to be regretted that his exceptional genius was thus marred. He had in oils a broad range of subjects. There are the numerous portraits; marines ('Valparaiso Harbor'; 'Blue Wave — Biarritz'; 'The Ocean'; and landscapes of many sorts, especially those interpretative of night. His method was to apply many coats of thin color instead of one or a few of greater consistency' this guarantees to his work a superior permanence. He was above all the colorist and in pure line and color harmonies has been called one of the supreme artists. His work has repeatedly been compared to that of Velasquez, but study shows very important dissimilarities and Whistler must remain unique. He borrowed somewhat from Oriental art, though always subordinating these elements to his own ends. Among portraits not referred to is that of Carlyle, now in the Glasgow Museum, of which the philosopher observed, "weel, man, you have given me a clean collar, and that is more than Meester Watts has done." Whistler did some work in interior decoration, such as the music-room of Sarasate (Paris) and the "Peacock-room" for Mr. Leyland (London). Many fine examples of his paintings are in American galleries, public and private. His place in the history of world art cannot yet be estimated, but he may safely be put among the greatest painters of the 19th century.

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WHISTLEWING, or **WHISTLER,** a duck. See GOLDEN-EYE.

WHISTON, hwis'tŏn, **William,** English mathematician and Anglican clergyman: b. Norton, Leicestershire, 9 Dec. 1667; d. London, 27 Aug. 1752. He took his degree at Clare Hall, Cambridge, in 1690, and in 1691 was elected to a fellowship there. He was ordained a deacon in 1693, was appointed chaplain to the bishop of Norwich, and in 1698 became vicar of Lowestoft, Suffolk. He was appointed deputy professor of mathematics to Newton at Cambridge in 1701, and in 1703, upon Newton's resignation, succeeded to the Lucasian professorship. He continued to preach, but having given expression to Arian views, was in 1710 summarily expelled from his professorship and the university. He removed to London where he published 'An Historical Preface to Primitive Christianity Revived' (1711). He was thereupon prosecuted for heresy, but after proceedings lasting five years, was permitted to remain in the English Church. He subsequently engaged in lecturing upon scientific subjects, being among the first to introduce lectures with experiments in London. He founded in 1715 a society for the promotion of primitive Christianity, the meetings of which were held in his home, and afterward became a Baptist. He made a translation of Josephus (1737) which ran through many editions and wrote 'New Theory of the Earth' (1696); 'The Accomplishment of Scripture Prophecies' (1708); 'A New Method of Discovering the Longitude' (1714); 'The True Origin of the Sabellian and Athanasian Doctrines of the Trinity' (1720); 'The Testimony of Phlegon Vindicated' (1732); 'The Longitudes Found by the Ellipsis of Jupiter's Planets' (1738); 'Memoirs' (1749), etc.

WHITAKER, hwit'a-kĕr, **Alexander,** American clergyman: b. Cambridge, England, 1585; d. Henrico County, Va., after 1613. He was graduated from Cambridge, was for some years rector of a north of England parish, settled in Henrico County, Va., in 1611 and was active in missionary work. He baptized Pocahontas and officiated at her wedding. He wrote 'Good Newes from Virginia,' (1613), one of the first books written in the colonies.

WHITAKER, hwit'a-kėr, **Daniel Kimball,** American editor: b. Sharon, Conn., 13 April 1801; d. 10 April 1881; grandson of the Rev. Nathaniel Whitaker. He was graduated at Harvard, 1820, studied law and settled in South Carolina, becoming the law partner of ex-Governor John Lyde Wilson. Though eminently successful as a lawyer, his preferences were for literature and he established and edited a number of periodicals, among them the *Southern Literary Journal* and *Whitaker's Magazine*. In 1841 he established at Charleston, S. C., the *Southern Quarterly Review*, which he edited until the Civil War. In 1866 he moved to New Orleans, La., and founded and for many years edited the New Orleans *Monthly Review*. He was corresponding secretary of the New Orleans Academy of Sciences.

WHITAKER, Edward Gascoigne, American judge: b. New York, 13 April 1853. He received his education at Southampton Academy and at a German university, and was admitted to the bar in 1876. In 1884 he was appointed deputy attorney-general of New York, which office he occupied for seven years. In 1912 he received the appointment as justice of the Supreme Court of New York, first district. As president of the State Bar Association (1897), Mr. Whitaker served on the committee concerned with international arbitration problems; was active in promoting expedient measures for the prompt publication of appellate reports, and was instrumental in establishing the system of uniform examinations for admission of students to the bar.

WHITAKER, John, English Anglican divine: b. Manchester, about 1735; d. Ruan-Langhorne, Cornwall, 30 Oct. 1808. He was educated at Oxford. In 1771 he published a 'History of Manchester,' and in refutation of Macpherson's theory that the modern Highlanders were descendants of the Caledonians of Tacitus, wrote his 'Genuine History of the Britons' (1772), maintaining that they were descended from an Irish colonization which followed the Roman invasion. In 1778 he was presented by his college to the rectory of Ruan-Langhorne. His most important works are 'Sermons upon Death, Judgment, Heaven and Hell' (1783); 'Mary, Queen of Scots, Vindicated' (1787); 'The Origin of Arianism Disclosed' (1791); 'The Course of Hannibal over the Alps Ascertained' (1794); 'Life of Saint Neot' (1809).

WHITAKER, Joseph, English publisher: b. London, 4 May 1820; d. Enfield, Middlesex, 15 May 1895. In 1849 he started a church monthly called *The Penny Post*, soon after established a theological publishing business of his own in Pall Mall, and in 1856–59 was editor of *The Gentleman's Magazine*. He founded *The Bookseller* in 1858, but his name is remembered principally in the title of 'Whitaker's Almanac,' which first appeared in 1868. The 'Reference Catalogue of Current Literature' was started by him in 1874.

WHITAKER, Nathaniel, American Presbyterian clergyman: b. Long Island, N. Y., 22 Feb. 1732; d. Woodbridge, Va., 21 Jan. 1795. He was graduated from Princeton in 1752, entered the ministry and became pastor of a church at Chelsea, Conn, and visited England in 1765–66, accompanied by Samson Occom, an educated Indian, for the purpose of soliciting funds for the establishment of an institution of learning in America for the use of the Indians. His mission resulted in the foundation of Dartmouth College. He was subsequently engaged in pastoral duties in Massachusetts and in Maine, finally removing to Virginia. He was a staunch Whig and ardently supported the cause of the colonies during the Revolution. Several of his sermons were published.

WHITAKER, Ozi William, American Protestant Episcopal bishop: b. New Salem, Mass., 10 May 1830; d. 9 Feb. 1911. He was graduated from Middlebury College, Vermont, in 1856 and from the General Theological Seminary in 1863. He took priest's orders in the last-named year, was rector of Saint John's, Gold Hill, Nev. (1863–65), of Saint Paul's, Englewood, N. J. (1865–67), and of Saint Paul's, Virginia City, Nev. (1867–69). In 1869 he was consecrated missionary bishop of Nevada, was transferred to the diocese of Pennsylvania as assistant bishop in 1886, and upon the death of Bishop Stevens in 1887 became bishop of Pennsylvania.

WHITBREAD, hwit'brėd, **Samuel,** English politician: b. Cardington, Bedfordshire, 1758; d. 6 July 1815. He was educated at Oxford and Cambridge and entered the House of Commons in 1790 as Whig member for Bedford. He at once made his mark as an able advocate of Parliamentary reform, religious and civil liberty, the abolition of slavery and similar liberal causes, and as a strong opponent of Pitt's war policy. He took a leading part in the impeachment of Viscount Melville in 1805–06 and against Lord Chatham for his mismanagement of the Walcheren Expedition in 1809. He committed suicide after being engaged in a very trying controversy over the rebuilding of Drury Lane Theatre. Consult 'The Creevy Papers' (1903).

WHITBY, hwit'bi, Canada, capital of Ontario County, a town and port of entry on Lake Ontario, at the southern terminus of the Whitby and Port Perry Railway, and on the Grand Trunk Railway, 30 miles east of Toronto. It has iron foundries, tanneries, manufactories of agricultural implements, mill machinery and musical instruments and carries on an active agricultural trade. Pop. 2,500.

WHITBY, England, seaport in the North Riding of Yorkshire, 48 miles north-northeast of York, at the mouth of the Esk, which divides it into two parts. The houses are ranged on bold acclivities and an ancient restored cruciform church stands on the verge of a lofty cliff; there are several modern churches and Non-Conformist chapels; a town-hall, courthouse, museum, temperance hall, seamen's hospital, etc. The harbor is spacious and commodious, having wet and dry docks, etc. The manufacture of jet ornaments is carried on, a very hard black ossified wood being abundant in the neighborhood. There are also yards for ship and boat building and productive sea fisheries. In 657 Saint Hilda founded her famous priory on the site of Whitby, then called Streoneshalh, and in it was held the important Synod of Whitby in 664, at which the Roman usage as regarded Easter was adopted (see EASTER). The poet

1773; d. Knoxville, Tenn., 10 April 1840. He served as a volunteer against the Cherokees in 1792, studied law and began practice at Knoxville in 1796. He was judge of the Supreme Court of Tennessee, 1801–07, and 1809–15, became United States district attorney in 1807, in 1809 was elected to the State senate, was president of the Bank of Tennessee in 1815–27, State senator in 1817–25, United States commissioner in 1821–24 for the adjustment of claims against Spain, and in 1825 was elected to the United States Senate to succeed General Jackson. He was opposed to the making of internal improvements by the Federal government, and led in the movement which resulted in the abolishment of the National Bank. He was an earnest advocate of the removal of the Indians west of the Mississippi, and by his support of the bill to limit executive patronage incurred the enmity of Jackson. In 1835 he was nominated for the Presidency, his electors carried Georgia and Tennessee, and he received 25 votes in the electoral college. He became a declared Whig in 1838, and in 1839 resigned his seat in the Senate because of his unwillingness to vote for the Sub-Treasuary Bill, as he had been instructed to do by the Tennessee legislature. Consult Scott, Nancy N., 'Memoir of Judge White' (1856).

WHITE, Israel Charles, American geologist: b. Monongalia County, W. Va., 1 Nov. 1848. He was graduated at West Virginia University in 1872. He was assistant geologist of the Pennsylvania Geological Survey in 1875–84; of the United States Geological Survey in 1884–88; and in 1877–92 he was professor of geology at West Virginia University. He resigned his professorship in 1892 in order to take charge of a large petroleum business, and since 1897 he has been State geologist of West Virginia. He is an authority on coal, petroleum and natural gas, and with Edward Orton he was co-developer of the anticlinal theory of gas accumulation. The West Virginia 'Geological Survey' contains many of his reports.

WHITE, James, Canadian geographer: b. Ingersoll, Ontario, 3 Feb. 1863. He was graduated at the Royal Military College, Kingston, in 1883. He was a government surveyor in the Rocky Mountains, Quebec and Ontario in 1884–94; was geographer and chief draughtsman of the Canadian Geological Survey in 1894–99; and was chief geographer of the Department of the Interior in 1899–1912. He was appointed secretary of the Royal Conservation Commission in 1909, and became its assistant chairman and deputy head in 1913. Since 1917 he has also been chairman of the advisory board on Wild Life Protection. He has published a relief map of Canada, and several large scale maps; and is author of 'Altitude in Canada' (1901); 'Maps and Map Making in Canada' (1905); 'Atlas of Canada' (1906); 'Oregon and San Juan Boundaries' (1908); 'Derivation of Place Names in Canada' (1912); 'Dictionary of Altitudes' (1903; 1916), etc.

WHITE, James William, American surgeon: b. Philadelphia, Pa., 2 Nov. 1850; d. there, 24 April 1916. He was graduated M.D. and Ph.D. at the University of Pennsylvania in 1871, and in 1871–72 served on Professor Agassiz's staff in the Hassler Expedition to the West Indies, the coasts of South America and the Straits of Magellan. He then engaged in practice at Philadelphia, held several hospital charges and was successively professor of genito-urino surgery, of clinical surgery and John Rhea Barton professor of surgery at the University of Pennsylvania until he retired, becoming professor emeritus. He was attached to the American Ambulance Hospital at Neuilly, France, in 1915. Aberdeen University conferred the degree LL.D. on him in 1906. He left a bequest of $400,000 to the University of Pennsylvania. He was co-author of 'American Text-Book of Surgery' (1896); 'Genito-Urinal Surgery' (1897); 'Human Anatomy' (1906), and author of 'Text-Book of the War for Americans' (1915).

WHITE, John Blake, American artist and author: b. Eutaw Springs, S. C., 2 Sept. 1781; d. Charleston, S. C., 24 Aug. 1859. He studied under Benjamin West in London in 1800–04. Returning to the United States, he established himself in Boston, but on account of the lack of practice went to Charleston, S. C., and became a lawyer, was successful in that profession, and was several times a member of the South Carolina legislature. His best-known picture, 'The Unfurling of the United States Flag in the City of Mexico,' was destroyed during the Civil War. His other paintings include 'Battle of Eutaw Springs' (1804); 'Battle of Fort Moultrie' (1806); 'Battle of New Orleans'; 'Mrs. Motte Presenting the Arrows', and 'Marion Inviting the British Officer to Dinner' (1836). He also wrote the dramas 'Foscari, or the Venetian Exile' (1805); 'Mysteries of the Castle' (1806); 'Modern Honor' (1812); 'Triumph of Liberty, or Louisiana Preserved' (1819), and 'Intemperance' (1839).

WHITE, John Campbell, American religious worker and university president; brother of Wilbert W. White (q.v.): b. Wooster, Ohio, 31 March 1870. He was graduated at the University of Wooster in 1890. In 1890–91 he was national college secretary of the Young Men's Christian Association, and he was traveling secretary of the Student Volunteer Movement in 1891–92. He was general secretary of the Y. M. C. A. at Calcutta, India, in 1893–1903, and served as secretary of the ways and means committee of the United Presbyterian Church in 1903–06. He was secretary of the Laymen's Missionary Movement in 1907–15, and has since been president of the University of Wooster. He is author of 'Missions and Leadership' (1915).

WHITE, John Hazen, American Protestant Episcopal bishop: b. Cincinnati, Ohio, 10 March 1849. He was graduated from Kenyon College in 1872, and Berkeley Divinity School, Middletown, Conn., in 1875. He was ordained priest in 1876, was rector of Grace Church, Old Saybrook, Conn., 1878–81; of Christ Church, Joliet, Ill., 1881–89; Saint John's Church, Saint Paul, 1889–91, and warden of Seabury Divinity School, Faribault, Minn., 1891–95. In the last-named year he was consecrated bishop of Indiana, and on the division of the diocese in 1899 chose the northern portion with the title of bishop of Michigan City.

WHITE, Joseph Blanco, English clergyman and author: b. Seville, Spain, 11 July 1775;

d. Liverpool, 30 May 1841. After study in Seville University, he was ordained sub-deacon (1796) and priest (1800) in the Roman Catholic Church, in 1802 was appointed to a chaplaincy in the Chapel Royal of Saint Ferdinand at Seville, but having abandoned his belief in Christianity, withdrew from the priesthood, and went to England in 1810. There he became editor of *Español*, a monthy periodical, circulated in Spain (partly by the English government) in aid of the national cause; in 1812 again became a Christian; and in 1814 qualified as an English clergyman. He began contributing in 1820 to the *New Monthly*, edited by Thomas Campbell (q.v.), and in 1825 published 'Evidences against Catholicism.' In 1826 he settled at Oxford as a member of Oriel, and there Newman, Pusey and other leaders of the Oxford movement learned much from him respecting Catholic theology. He finally became an acknowledged Unitarian, and from 1835 lived at Liverpool, doing some desultory literary work. Many of his books had a real interest in their time; but he is best known to literature by his sonnet 'Night and Death,' which Coleridge, in a letter of 1827, declared to be the finest in the English language. Among his further publications are 'Letters from Spain by Don Leucadio Doblado' (1822); 'Second Travels of an Irish Gentleman in Search of a Religion' (1833); in answer to Thomas Moore's 'Travels,' and 'Observations on Heresy and Orthodoxy' (1835).

WHITE, Octavius Augustus, American physician: b. Charleston, S. C., 8 Feb. 1826; d. New York, 25 May 1903. He was graduated from the College of Charleston in 1846 and from the South Carolina Medical College in 1848, he practised with success until the outbreak of the Civil War, and he was made surgeon in the Confederate army. He became an expert on yellow fever, during the war he was sent within the Union lines at Goldsborough, N. C., for medical services connected with the fever, and wrote much on the subject, as well as on general topics of medicine and surgery. Several professional inventions are to be credited to him.

WHITE, Percy, English novelist: b. London 1852. He taught English literature and language in a French college for some years, entered journalism in 1880 and for 10 years edited *Public Opinion*. He has published several brilliant novels, strongly satirical in character, among them being 'Mr. Bailey-Martin' (1893); 'Andria' (1896); 'A Millionaire's Daughter' (1898); 'The Heart of the Dancer' (1900); 'The New Christians' (1902).

WHITE, Peregrine, the first child born in New England of English parents: b. on board the *Mayflower*, in the harbor of Cape Cod, 20 Nov. 1620; d. Marshfield, Mass., 22 July 1704. He was the son of William and Susanna White, and on account of his birth received 200 acres of land from the General Court. He filled various civil and military offices, and "was virorous and of a comely aspect to the last." His father died during the colonists' first winter at Plymouth, and the marriage of his mother to Gov. Edward Winslow was the first wedding in New England.

WHITE, Richard Grant, American author and critic: b. New York, 22 May 1821; d. there, 8 April 1885. He was graduated from the New York University in 1839, studied medicine and then law, and became a contributor of musical, art and dramatic critiques to the New York *Courier and Enquirer*. From 1854 to 1859 he was an editor of this journal; and of the *World*, 1860–61. His 'Yankee Letters,' contributed in 1863–67 to the London *Spectator*, were interesting narratives of contemporary events and of considerable service to the national cause. In 1861–78 he was chief clerk of the United States revenue marine bureau for the district of New York. White was particularly known as a Shakespearean scholar. He contributed articles on Shakespeare to *Putnam's Magazine* in 1853, in 1854 published 'Shakespeare's Scholar,' and in 1857–63 a critical edition of the poet's works. Other volumes on this general subject were, 'Essay on the Authorship of the Three Parts of Henry The Sixth' (1859); 'Memoirs of William Shakespeare, with an Essay toward the Expression of his Genius' (1865), and the posthumous 'Studies in Shakespeare' (1885). White's 'Riverside edition of Shakespeare' (1883) was one of the most popular prepared by an American. He was also one of the leading American critics of his time, dogmatic at times and over-hasty in generalization, but vigorous, acute and frequently brilliant. Philological studies were represented by his 'Words and their Uses: A Study of the English Language' (1870; rev. ed., 1872), and 'Every-Day English' (1881). The most widely circulated of his writings was the anonymous satire 'The New Gospel of Peace' (1863–66). He also wrote a novel 'The Fate of Mansfield Humphreys' (1884), and edited 'Illustrated Record of the New York Exhibition of the Industry of All Nations' (1854), and 'Poetry, Lyrical, Narrative, and Satirical of the Civil War' (1866). His scholarship was considerable, his style readable and often marked by satire, and his authority in his day decided. An interesting article regarding him by F. P. Church appeared in the *Atlantic* for March 1891, Vol. 67.

WHITE, Stanford, American architect: b. New York, 9 Nov. 1853; d. New York, 25 June 1906. He was the son of Richard Grant White (q.v.) and was graduated from the University of New York and received his professional training under Charles D. Gambrill and H. H. Richardson, and was the chief assistant of the latter in the construction of Trinity Church, Boston. In 1881 he became a member of the firm of McKim, Mead and White. He was the designer of Madison Square Garden, the Washington Arch, the Tiffany apartments, Columbia University Library, the Century and Metropolitan Club buildings, and other important structures. He was killed in the Madison Square Garden, New York, by Harry K. Thaw

WHITE, Stewart Edward, American novelist: b. Grand Rapids, Mich., 12 March 1873. He was graduated from the University of Michigan in 1895 and studied law at the Columbia Law School (1896–97). He has published stories of Western life, including 'The Westerners' (1901); 'The Claim Jumpers' (1901); 'The Blazed Trail' (1902); 'Con-

juror's House' (1903); 'The Forest' (1903); 'The Mystery' (1907); 'The Cabin' (1910); 'The Land of Footprints' (1912); 'Gold' (1913); 'Rediscovered Country' (1915).

WHITE, Wilbert Webster, American religious leader and educator, brother of J. C. White (q.v.): b. Ashland, Ohio, 16 Jan. 1863. He was graduated at the University of Wooster in 1881, at Xenia Theological Seminary in 1885, and took his Ph.D., at Yale University in 1891. In 1890–95 he was professor of Hebrew and Old Testament Literature at Xenia Theological Seminary; and after serving as a teacher at the Moody Bible Institute, Chicago, in 1895–97 he engaged in religious work in England and India in 1897–1900. In 1900 he became president of the Bible Teachers' Training School, New York. He is editor of the Biblical Review and is author of 'Thirty Studies in Jeremiah' (1895); 'Thirty Studies in Revelations' (1897); 'Studies in Old Testament Characters' (1900; 2d ed., 1904); 'Thirty Studies in the Gospel by Matthew' (1903), etc.

WHITE, William, American Protestant Episcopal bishop: b. Philadelphia, Pa., 4 April 1748; d. there, 17 July 1836. He was graduated at the College of Philadelphia in 1765, completed his theological studies in 1770, and going to England to obtain holy orders, was admitted to the diaconate by the bishop of London in 1770, and to the priesthood by the bishop of Norwich in 1772. Returning to Philadelphia, he became assistant minister and afterward rector of Christ Church and Saint Peter's Church, being at one period the only Episcopal clergyman in Philadelphia, and in 1777 was chaplain to Congress. The degree of D.D., the first honorary degree of the University of Pennsylvania, was conferred on him 1782. The meeting which issued the summons for a convention preparatory to organizing the Protestant Episcopal Church, was held at his house in 1784 and he presided over the First General Convention in 1789. In 1786 he was elected bishop of Pennsylvania and was consecrated in Lambeth palace, England, 1787. He wrote 'Memoirs of the Protestant Episcopal Church' (1820); 'Lectures on the Catechism' (1813), etc. Consult 'Memoir,' by Bird Wilson (1839); McConnell, 'History of the American Episcopal Church' (1890).

WHITE, William Alanson, American neurologist and alienist: b. Brooklyn, N. Y., 24 Jan. 1870. He studied at Cornell University in 1885–89, and was graduated M.D. at the Long Island College Hospital in 1891. He was assistant physician at the New York State Hospital for the Insane at Binghamton in 1892–1903, and since 1903 he has been superintendent of Saint Elizabeth's Hospital for the Insane at Washington, D. C. He has also held the chair of nervous and mental diseases at Georgetown University since 1903 and at George Washington University since 1904, as well as lecturing at the United States Naval and Army Medical School. He has collaborated with Dr. Smith Ely Jelliffe (q.v.) in preparing different medical treatises. Author of 'Mental Mechanisms' (1911); 'Outlines of Psychiatry' (5th ed., revised 1915), etc.

WHITE, William Allen, American author: b. Emporia, Kan., 1868. He was educated at the University of Kansas and in 1890 became editor of the Eldorado *Daily Republican*. He afterward was engaged on the editorial staffs of the Kansas City *Journal* and of the *Star*, and in 1894 purchased the Emporia *Gazette*. His editorial, 'What's the Matter with Kansas?' published in that paper in August 1896, was read and reprinted throughout the country. He has published 'The Real Issue' (1896); 'The Court of Boyville' (1899); 'Stratagems and Spoils' (1901); 'A Certain Rich Man' (1909); 'The Old Order Changeth' (1910); 'God's Puppets' (1916); 'In the Heart of a Fool' (1918); 'The Martial Adventures of Henry and Me' (1918), etc.

WHITE, Sir William Henry, English naval constructor: b. Devonport, 2 Feb. 1845; d. 1913. He was educated at the Royal School of Naval Architecture, served in the constructive department of the Admiralty, 1867–83, becoming chief constructor, and from 1870 to 1881 was professor of naval architecture at the Royal School of Naval Architecture and at the Royal Naval College. In 1883–85 he organized and directed the warship building department of Armstrong and Company, Newcastle. From 1885 to 1902 he was director of naval construction and assistant comptroller of the navy, and during that period was the responsible designer of all British ships of war. Upon his resignation, due to failing health, he received from Parliament a special money grant in recognition of his services to the navy. He has published 'A Manual of Naval Architecture'; 'Architecture and Public Buildings'; 'A Treatise on Shipbuilding,' and numerous professional papers.

WHITE, Sir William Thomas, Canadian statesman: b. Bronte, Ontario, 13 Nov. 1866. He was graduated at Toronto University in 1895 and was called to the bar of Ontario in 1899. He was for some years engaged in newspaper work on the staff of the Toronto *Evening Telegram*, and later was connected with the assessment department of the Toronto municipal government. He became prominent in financial circles and was president of the National Trust Company in 1900–11. He was a determined opponent of the Reciprocity Treaty between Canada and the United States, and although a Liberal in politics was instrumental in defeating the Laurier Ministry. He has been Minister of Finance in the Conservative Cabinet of Sir Robert L. Borden since October 1911. He was knighted in 1916.

WHITE ANTS. See TERMITES.

WHITE BASS. See BASS.

WHITE BOOK, a government publication in Germany and Portugal, corresponding to the British Blue Book and the Yellow Book of France. See BLUE BOOKS.

WHITE BOYS, an illegal association formed in Ireland in 1760, composed of starving day-laborers, evicted farmers and others in a like condition, who used to assemble at nights to destroy the property of landlords or their agents, the Protestant clergy, the tithe collectors or any others that had made themselves obnoxious in the locality. In many cases they did not confine their acts of aggression merely to plunder and destruction, but even went the length of murder, [illegible]

WHITE BRETHREN a sect which caused a commotion in Europe about the beginning of the 15th century. A priest whose origin is unknown, his nationality being variously alleged as Spanish, French and Scotch, made his appearance in Lombardy, and said that he was the prophet Elias, and had come back from heaven to give notice of the coming destruction of the world. He had thousands of followers, who were arrayed in white, and carried large crucifixes, as they marched from the Ligurian Alps into central Italy. Pope Boniface IX caused him to be apprehended, and he was burned as an impostor. The White Brethren then dispersed.

WHITE CAMELIA, The Knights of the, formed in May 1867 at New Orleans, was the largest of the revolutionary orders called into existence by the misgovernment of Reconstruction. Its principal strength was in the Gulf States, farther south than the notorious Ku Klux Klan (q.v.). The organization was as follows: A supreme council for the United States; a grand council in each State; a central council in each congressional district and councils in each county. Each council was divided into circles and groups. The officers of the council were known as commander, lieutenant-commander, etc.; the members were called "brothers." The objects of the order were, to nullify radical legislation, to reduce the influence of the blacks in politics, to prevent amalgamation of the races and to defend the white race against radical encroachment. The members swore to vote for no black for office, to observe always a marked distinction between the races, to maintain the social and political superiority of the white race, at the same time protecting the blacks in the privileges rightfully theirs. The constitution forbade the indorsement of any political party by the order. Each member was free to vote as he pleased, subject to his oath always to oppose negroes for office, or those favorable to negro political rights. The order sometimes operated also as a body of regulators using such methods as were usually attributed to the Ku Klux Klan, but the membership was of a higher order. The discipline was good and the effect of its operations was to control the lawless negroes, intimidate and drive from the country the carpet-baggers and to secure again to the whites control of the State and county governments. These objects being accomplished, the order gradually disbanded. Its secrets were well kept and not until recent years was anything definite known of the order. The White Brotherhood and the White League were closely related orders that existed in the same territory a few years after the White Camelia had disintegrated. Consult Brown, 'Lower South American History' (1902); 'Constitution and Ritual of the Knights of the White Camelia,' in West Virginia University Documents relating to Reconstruction, Nos. 1 and 2.

WHITE CAPS, in American history, the lawless bands in southern Indiana, who, from 1880, undertook the regulation of the manners and morals of that section. During the Civil War, the Knights of the Golden Circle (q.v.) flourished in the same parts. The White Caps dressed differently in different parts of the country which they terrorized. Where they were regularly organized and did the most mischief they generally had nearly a full uniform or regalia. They wore white paper foolscaps, with paper masks, and coats of coffee sacking. To make the coats they merely cut arm or sleeve holes in the sides of coffee sacks close to the bottoms and holes in the bottoms to put their heads through.

WHITE CATTLE (of Chillingham), certain cattle preserved in a semi-wild state in Chillingham Park, England. They are pure white, except the muzzle, which is black, and the horns which are tipped with black. The white color on the body, however, is artificially produced, the owner causing all spotted calves to be killed. They are now generally believed to be the descendants of the mountain bull or urus (see Ox), which was wild in Gaul at the time of Cæsar's invasion, and the stock whence modern breeds of domestic English cattle have been partly derived. Dawkins, however, considers them the last surviving representatives of a still more primitive race, the gigantic ox, known by its remains in caves to have occupied Great Britain in the Pleistocene Period. He considers them much modified in every respect by their small range and their contact with man.

WHITE CLOVER, OAK PINE. See CLOVER; OAK; PINE.

WHITE COLORS, *in painting,* white pigment or white lead. Baryta yields several commercial varieties of white color, largely used for adulterating white lead. The substances used are heavy spar, the native sulphate, and witherite, the native carbonate, of baryta. An artificial sulphate of baryta is also used in permanent white. Zinc white or Chinese white is a hydrated oxide of zinc and pearl white is yielded by the nitrate of bismuth. A fine chalk yields Spanish white, and whiting is ordinary ground chalk. Quicklime is a sanitary white for external walls, etc.

WHITE CROSS, a self-supporting American organization which had a large membership throughout the Union, having for its motto, "Truth, Charity and Philanthropy," and for its emblem cross bandages of white on a field of red. It was founded in 1898 by Mrs. Jane Creighton of Portland, Ore., and its object was the care of wounded and sick American soldiers and sailors, and aid to the widows and orphans of those who had fallen in battle, or died of disease or accident.

WHITE CROSS SOCIETY, an association founded in England, in 1883, by the bishop of Durham, and introduced in the United States in that year by the Rev. B. F. De Costa, rector of the Protestant Episcopal Church of Saint John the Evangelist, New York, who became a Roman Catholic in 1899. The objects of the society are "to urge upon men the obligation of personal purity; to raise the tone of public opinion upon the subject of morality; to secure proper legislation in connection with morality." Those who become members of the society promise "by the help of God" to treat all women with respect and endeavor to protect them from wrong and degradation; to endeavor to put down all indecent language and coarse jests; to maintain the law of purity as equally

landing on men and women; to endeavor to spread these principles and try to uplift younger brothers and to use every possible means to fulfil the command, "Keep thyself pure." The society seeks to forward its objects "by the full presentation of those spiritual truths which form distinguishing characteristics of Christianity and demonstrate its unalterable hostility to every form of impurity." The Society has been established also in Canada.

WHITE-CROWNED SPARROW. See SPARROW.

WHITE EAGLE, Order of. See ORDERS (ROYAL) AND DECORATIONS.

WHITE ELEPHANT, an elephant affected with albinism. Such animals, always rare, are highly esteemed by some Eastern potentates and are considered sacred in Siam, where the animal has become a national symbol, so that Siam is called "the land of the white elephant," and one of the highest decorations conferred by its rulers is that of the Order of the White Elephant. A specimen purchased by the late P. T. Barnum from King Theebaw, of Burma, was brought to the United States in 1884. It stood seven feet and a half high and the face, ears, front of trunk, fore feet and part of breast were of a light ash color. Figuratively, a present which does one much more harm than good, or more generally any nominal advantage which has this effect. It is reported that when in old times the ruler of Siam desired to ruin any one, he made him a present of a white elephant. The sacred elephant has an enormous appetite, and, being sacred, it would be a crime to let it die, so that the gift generally entailed ruin on the recipient.

WHITE-EYES, one of the numerous small insectivorous birds of the New Zealand region, called blight-birds locally, because they feed so largely upon the plant-lice which torment garden plants and orchard trees. They belong to the genus *Zosterops*, which is variously classified by ornithologists, but seems most nearly related to the titmice. Other species are scattered elsewhere throughout the Old World tropics. All are neatly but not gaudily dressed have in most cases a conspicuous ring of white feathers around the eye and build pretty nests. The genus is interesting, further, from the fact that many of its species are confined to small islands, apparently affording examples of the effect of isolation (q.v.).

WHITE FEATHER, a symbol of cowardice; a term introduced in the days when cock-fighting was in vogue. As a thoroughbred game cock has no white feathers, a white feather was a proof that the bird was not game.

WHITE FLY, a minute insect of the family *Aleyrodidæ*, closely allied to the aphids and coccids, which infest the leaves of plants, usually on the lower side, and are pests in greenhouses. (See GREENHOUSE INSECTS). They are covered with a whitish mealy secretion, and when young also secrete wax. The group is not a large one and does not do much harm to fruit or forest trees, except that one species (*Aleyrodes citri*) has been prevalent in Florida orange groves since about 1890. The evil they do results not only from their sucking the nutritive juices of the plants, but from the spread of smut-fungus which is promoted by their presence. Consult Howard, 'The Insect-book' (New York 1901).

WHITE FRIARS, a name formerly given to the friars of Our Lady of Mount Carmel, because they wore a white scapular and cloak over their brown habit. See CARMELITES.

WHITE GOAT. See ROCKY MOUNTAIN GOAT.

WHITE HATS, a badge of the Democratic party in Flanders in the 14th century. White hats were used in England to denote radical proclivities, because Orator Hunt (1773–1835), the great demagogue, during the Wellington and Peel administration, used to wear a white hat.

WHITE HELLEBORE, a liliaceous plant of the genus *Veratrum*, a source of insect-poison, the principle of which is the alkaloid veratrin. See also HELLEBORE.

WHITE HOUSE, the official residence of the President of the United States, in Washington, D. C. The name arose from the fact that the building is constructed of freestone and painted white. It is 170 feet long, 86 feet deep and two stories in height. It has an Ionic portico, the main entrance faces north. Reception rooms are on the first floor and the private apartments of the President are on the second floor. Among the reception rooms are the Blue Room used for diplomatic functions, the East Room used for public receptions, and the Red and Green rooms. The original official residence for the President was begun in 1792; it was first occupied by Adams, in 1800. In 1814 it was burned by the British and four years later was rebuilt. In 1903 executive offices connected with the main building were built on the grounds. President Harrison and McKinley used for the official name, "Executive Mansion"; President Roosevelt returned to the old name, White House.

WHITE LADY, an apparition which figures in the legends and traditions of various countries, as presenting herself to give warning of death and other momentous events in royal and titled households. The White Lady is supposed to be an ancestress of the family she visits, and the association of such a legend with a family name is regarded as a guarantee of noble and ancient lineage. The one-time imperial house of Hohenzollern had its White Lady, and Hampton Court, England, is said to be invaded at times by a supernatural visitor, although there seems to be some doubt whether it is a White Lady or the ghost of Henry VIII. The earliest historical instance of the apparition is recorded as having occurred in the 15th century and is celebrated under the name of Bertha of Rosenberg, in Bohemia. Similar appearances are said to have been witnessed in the Schloss at Berlin, one as recent as 1879.

WHITE LEAD, a white pigment very largely used in painting. Many processes have been devised for its manufacture. The old Dutch method was to expose sheet lead in coils, placed in earthenware jars partly filled with vinegar, to the combined action of air, moisture and carbonic acid gas. This was done by immersing the jars with their contents in decomposing horse manure which furnished the heat and carbonic acid gas necessary for the

process. The English process, which is the one by which most of the white lead is made, differs from the Dutch process by the use of fermenting tan bark instead of manure. The pots containing the lead and dilute acetic acid or vinegar are piled in rows in the so-called stacks and surrounded with the fermenting tan bark. After about three months the lead is removed and purified. The process is slow and the methods of purification dangerous to the workmen, but the resulting white lead is of the best quality. In the French method a solution of basic lead acetate is first prepared by the action of an impure acetic acid on litharge or lead oxide. Carbonic acid gas is then passed through this solution and the white lead precipitated. White lead is also produced electrolytically, by employing a solution of sodium-nitrate, preferably in a cell of wood and a porous diaphragm. The anode is of lead and the cathode of copper. When the current is turned on, nitric acid appears at the anode as lead nitrate and from the cathode appears caustic soda. The lead hydroxide obtained is later treated with sodium bicarbonate to secure the carbonate of lead. White lead is subject to frequent adulteration. It may be tested for purity by making a solution of the powder in acetic acid, which should take up all the lead and leave the adulterant. White lead is a basic carbonate of lead of somewhat variable composition. That formed by the Dutch and English processes may be represented by the formula $2PbCO_3.Pb(OH)_2$.

WHITE LEAGUE, The, in American history, a popular name for a semi-military organization, gathered to repress the negroes of the State of Louisiana, who, it was asserted, were meditating insurrection. The organization had its inception in New Orleans in 1874 and on the refusal of the city authorities to allow the landing of a cargo of firearms, which the league had imported from New York, a riot ensued which resulted in more than 100 deaths. The league afterward became a powerful factor in Louisiana politics.

WHITE METAL, a term used for an alloy of lead, antimony and tin used for bearings in machinery. Also applied to many other alloys that have a white color.

WHITE MONKS. See *Bernardines* under ORDERS, RELIGIOUS.

WHITE MOUNTAINS, a group of peaks and hills, or a range of monuments, principally in New Hampshire, in the northern part; but which extend into Maine on the east and on the west are connected with the Green Mountains in Vermont. They belong to the Appalachian system. Mount Katahdin, in Maine, is the highest elevation on the eastern rim, and in New Hampshire there are about 20 peaks, with deep narrow valleys and long lines of rounded foot-hills. The peaks are in two groups; the eastern or White Mountain group proper and the Franconia group, separated by a tableland varying from 10 to 20 miles in width. The principal summits of the eastern group are, beginning at the Notch and passing around to Gorham, Mounts Webster, Clinton, Pleasant, Franklin, Monroe, Washington, Clay, Jefferson, Adams and Madison. Of these Mount Washington is the highest and is indeed the highest mountain summit in New England, being 6,293 feet above the level of the sea. The principal peaks of the Franconia group are Pleasant, Lafayette, Liberty, Cherry and Mooschillock. Near the southern border of the plateau are Whiteface, Chocorua, Red Hill and Ossipee, and in the southeast, Kearsarge. North of the plateau and near the upper waters of the Connecticut, are several elevations, among which are the twin mountains known as Stratford peaks. The plateau is deeply furrowed by several streams. The geological formation of the White Mountains is almost entirely of ancient metamorphic rocks. In many of the peaks the upper portion is composed of huge masses of naked granite or gneiss, and the debris which in the course of ages has clothed the lower portion with a coarse gravelly soil, possesses only enough of the constituents of vegetable life to support those trees and shrubs which will grow in the hardest and poorest soil. Land slides, the result of dislodgment of bowlders and loosely adherent soil after heavy rains, are not infrequent. One of these occurred in the notch of the White Mountain group in August 1826 and destroyed a whole family named Willey. The most noteworthy of many waterfalls among the mountains are the Artist's Fall in North Conway; the Silver Cascade, a beautiful thread of water descending from far up the side of Mount Webster; Ripley's Falls, on a tributary of the Saco, below the Willey house, the lower one, Sylvan Glade cataract, falling at an angle of 45 degrees, 156 feet, in a stream from 50 to 75 feet in width; the falls of the Ammonoosuc, which in a course of 30 miles descends over 5,000 feet; the Berlin Falls on the Androscoggin, descending over 200 feet in the course of a mile, and the Crystal Cascade and Glen Ellis Fall, near the Glen house, on a tributary of the Androscoggin. Of the "notches," or passages (not rent through the solid granite of the mountains by some violent convulsion of nature as has often been supposed, but carved by the slow action of rivers), there are five; the White Mountain Notch, two miles in length and at its narrowest point only 22 feet wide, through which the Saco River passes; the Franconia Notch, which permits the passage of the Pemigewasset; the Pinkham Notch, through which a branch of the Saco and one of the Androscoggin find their way, and the Grafton and Dixville notches, through which flow the Androscoggin and one of its tributaries. The first two of these are those best known. "The Flume" at Franconia Notch is the most noted of those narrow waterways excavated through the rock, though there are others hardly inferior to it in attractiveness. Among the other objects of interest in the Franconia group is the "Old Man of the Mountain," a well-defined profile of the human face formed by three projecting rocks. (See FRANCONIA). At the base of the mountain lies a beautiful lakelet one-fourth of a mile long and one-eighth wide, called "Profile Lake," or the "Old Man's Washbowl." Five miles south of the notch is the "Basin," a circular bowl-like cavity 45 feet in diameter and 28 in depth, produced by the whirling of large stones in a natural hollow in the rock by the current. It is filled with clear sparkling water, which flows down the mountains in a succession of beautifully clear

cascades. The "Pool," in the same vicinity, is a natural well in the solid rock 60 feet in diameter and 190 feet deep, of which 40 feet is water. The White Mountains were first visited by a white man, Darby Field, of Pascataquac, in 1642, when with two Indians he ascended Mount Washington. Later in the same year Thomas Gorges and companions traveled up the Saco and explored the mountains and the plateau and discovered the sources of the Saco, Connecticut, Androscoggin and Kennebec rivers. The White Mountains are a famous summer resort. Several railroads enter the mountains, and in the seasons special trains carry passengers direct from many of the large cities.

WHITE OAK SWAMP, Battle of. See GLENDALE, BATTLE OF.

WHITE PLAINS, N. Y., village, county-seat of Westchester County, on the Harlem Division of the New York Central and Hudson River Railroad, about 20 miles from the central part of New York City. It has several manufactories and has grown rapidly as a residential suburb. It has a high school, opened in 1894, graded elementary public and parish schools, Saint John's Academy for Boys, Good Counsel Training School, several private schools and a public library. Bloomingdale Asylum for the Insane occupies a prominent position overlooking the village, nearby are several beautiful lakes, connected with the water supply of New York City. Several golf clubs maintain splendid grounds, as does also the Westchester Fair Association. It has been an incorporated village since 1886, and owns and operates the waterworks. The government is vested in a president and board of trustees. Pop. 19,287.

White Plains and vicinity were the scenes of many battles and skirmishes during the Revolution. Fortifications or their ruins were to be seen on all sides. On 21 October Washington established his headquarters at White Plains. On the evening of 27 October Haslett with about 1,600 American troops had taken possession of Chatterton Hill, a commanding eminence on the west side of the Bronx, and on the morning of the 28th, re-enforced by a small additional force under McDougall and two pieces of cannon under command of Alexander Hamilton, he fortified his position as well as time would allow. On the morning of that day Howe advanced with his forces in two columns (numbering about 13,000 men) upon the American army posted along the Bronx. Perceiving the importance of the position on Chatterton Hill and regarding it as the only assailable point of the American army, Leslie was sent with a strong detachment to cross the Bronx and attack it in front, while Rall with a Hessian regiment was ordered to cross the river a quarter of a mile below and attack Haslett in flank. The hill was carried with great difficulty, the Americans retreating in good order and without being pursued. The British troops rested that night on Chatterton Hill. The next day, 29 October, a skirmish took place between the two armies; but Howe, finding the Americans still too strongly posted to be attacked with safety, waited for re-enforcements. These arrived on the evening of the 30th, but a storm coming on, the Americans took advantage of it and withdrew to the still stronger position of Newcastle, two miles above, which they had previously fortified. Afraid to attack them in this position, Howe fell back to the junction of the Harlem and Hudson rivers and encamped on Fordham Heights, and Washington withdrew his army leisurely into New Jersey and made his headquarters at Hackensack. The loss of the Americans in the battle of White Plains and the skirmish of the succeeding days were nearly 300 in killed, wounded and prisoners, and that of the British about the same.

WHITE RIVER, in Arkansas, has its rise in the Ozark Mountains, in the northwestern part of the State, flows northeast into Missouri, forming a large curve and entering Arkansas again in Marion County, then flows southeast to the Mississippi River. It enters the Mississippi through several channels, some of which pass through the mouth-channels of the Arkansas River. Except in the highlands of the Ozark Mountains, the greater part of the course of the river is through marshy forest land. It is navigable to Batesville, about 300 miles. The total length is about 500 miles.

WHITE RIVER, in Indiana, the chief branch of the Wabash in the State, is formed by the confluence, in Pike County, of the East and West Fork, which have their rise near the eastern boundary of the State. From the junction of the two forks to the mouth of the White, where it enters the Wabash, is 50 miles; the total length from the source of the West Fork is 350 miles. The river is navigable to Martinsville on the West Fork and to Rockford on the East Fork.

WHITE RIVER, in South Dakota, the chief river of the southwestern portion of the State, rising in Dawes County, northwestern Nebraska, and flowing northeast into South Dakota, through Shannon and Washington counties, thence easterly to the Missouri River, which it joins a little south of Oacoma. The territory drained is locally known as the "Bad Lands," length about 425 miles.

WHITE RIVER JUNCTION, Vt., village in Windsor County, on the Connecticut River at the mouth of the White River and on the Central Vermont, the Boston and Maine and the Woodstock railroads, about 65 miles south by east of Montpelier and 14 miles east by north of Woodstock. It is a commercial centre for a large agricultural region in both Vermont and New Hampshire. The national bank has a capital of $100,000 and deposits amounting to over $1,275,000; the savings bank has deposits amounting to $481,150. White River Junction is in the town of Hartford and the government census does not give the population of the village separate. Pop. 4,179.

WHITE SAGE. See EUROTIA; GOOSEFOOT.

WHITE SANDS. A remarkable accumulation of granular gypsum in the Tularosa Desert in west-central part of Otero County, N. Mex. It consists mostly of dunes five to 50 feet high of dazzling whiteness and covers an area of about 270 square miles and its amount is at least 2,000,000,000 tons. Most of the material is nearly pure gypsum containing about 95 per cent of that mineral. To the north it grades into quartz sand. Attempts have been

made to utilize the deposit for manufacture of plaster of paris but local demand for this product is small and cost of long distance shipment is too great. The gypsum was carried into the basin in solution from the adjoining mountains and after crystallizing by evaporation of the water has been blown by the wind into dunes. Some of it is brought to the surface by ground water.

WHITE SEA, northern Russia, a large gulf opening into the government of Archangel, between the Kola Peninsula on the west and the Kanin Peninsula on the east. Near its mouth, and on the eastern side, is a branch called the Gulf of Mezen, which receives the waters of the river Mezen, and the inner part of the sea sends off three large arms, namely, the Gulf of Kandalak, penetrating northwest into Lapland, the Gulf of Onega, receiving the river Onega and the Gulf of Archangel, into which flows the Northern Dvina. Of the islands in the sea, Solovetskii is the largest. The White Sea is comparatively shallow, and is frozen over from October to May. Archangel, at the mouth of the Northern Dvina, is the leading port of northern Russia, and other ports on the shores of the sea are Onega and Kem. Canals connect the White Sea basin with basins of the Caspian, Baltic and Black Sea.

WHITE SULPHUR SPRINGS, Mont., city, county-seat of Meagher County, about 65 miles east by south of Helena. It is reached by stage from the Northern Pacific Railroad, a distance of about 40 miles. It is the commercial centre of a large agricultural, stock-raising and mining region and is noted for its thermal springs. The national bank has a capital of $100,000. Pop. 417, which includes only those within the limits and not the number who transact business in the city.

WHITE SULPHUR SPRINGS, W. Va., a district in Greenbrier County, on the Chesapeake and Ohio Railroad, about 230 miles west by north of Richmond and 90 miles west of Staunton. The locality has long been noted for its medicinal springs. The temperature of the water is 62° F. It is a famous health-resort. Pop. 338.

WHITE-SWELLING, any severe disease of the joints resulting from chronic inflammation in the bones, cartilages or membranes. The knee, ankle, wrist and elbow are the joints most subject to this form of disease. It is distinguished from simple inflammation of the synovial membrane (synovitis) by the fact that the synovial membrane passes into pulpy degeneration. Amputation is frequently necessary. The disease may be local or constitutional in origin, being in the latter case due to rheumatism, gout, syphilis, pyæmia, etc.

WHITE WHALE. See WHALE.

WHITEAVES, Joseph Frederick, Canadian paleontologist: b. Oxford, England, 26 Dec. 1835; d. 8 Aug. 1909. He studied at the University of Oxford in 1858-61 and made investigations of the land- and fresh-water mollusca and fossils of the oolitic rocks in the vicinity of Oxford, adding considerably to the information possessed. He removed to Canada in 1861, was engaged in geological investigations in Montreal and Quebec in 1861-62, and in 1863-75 he was curator of the museum and secretary of the Natural History Society of Montreal. He made a special study of the land- and fresh-water mollusca of Lower Canada in 1867-73. He was appointed to the Canada Geological Survey in 1875, became its paleontologist in 1876, and in 1877 was appointed zoologist and assistant director. He was one of the original Fellows of the Royal Society of Canada and contributed to the society's *Transactions* as well as to the *Canadian Naturalist* and similar periodicals.

WHITEBAIT, a small fish, called by Valenciennes *Rogenia alba,* and for which he constituted the genus *Rogenia* as a distinct genus of the Herring family (*Clupeidæ*), but which is now regarded by naturalists as merely the fry of the herring or of similar fish. The whitebait-fishery is actively prosecuted on some parts of the British Coast, particularly in the estuary of the Thames, where the whitebait is very abundant in spring and summer, beginning to appear in the end of March or early in April. Adult whitebait are caught on the coasts of Kent and Essex during winter, and in this condition are about six inches in length. Whitebait is found also in the Forth. It is much in request as a delicacy for the table. At the time when ordinarily captured, whitebait are only from one and one-half to four inches in length. They are caught by means of bag nets sunk four or five feet below the surface of the water. For several months they continue to ascend the river in shoals with the flood-tide and descend with the ebb-tide, not being able to live in fresh water. They are fried with flour or crumbs; they are often laid on a napkin and sprinkled with fine flour and a little salt, rolled about till well covered with flour and then thrown into a pot of boiling lard, where they remain till they are of a pale-straw color. The whitebait has the body more compressed than the mature herring; belly serrated; lower jaw longer than the upper; scales very soft, small and thin, and very easily rubbed off; color silvery white, greenish on the back. The food of the whitebait seems to consist of minute crustaceans. It is probable that under the name whitebait the fry of all the British *Clupeidæ* — the pilchard, the sprat and the shad — are indiscriminately taken and used like the fry of the herring.

WHITECHAPEL, London, England, a parish and parliamentary district, east of the nucleate city of London, one of the poorest portions of the metropolis, and formerly notorious for its criminal population. From 1888 to 1891 it was the scene of the atrocities of the mysterious Jack the Ripper. Within its boundaries are the Tower of London and London Hospital, and it is intersected by Whitechapel Road. The name is derived from a former mediæval chapel, whence all distances east of London were calculated. The pop. is about 100,000.

WHITEFIELD, hwīt'fēld, George, English evangelist, founder of the Calvinist Methodists: b. Gloucester, 16 Dec. 1714; d. Newburyport, Mass., 30 Sept. 1770. He was sent to the grammar school of Saint Mary de Crypt at Gloucester, and at 18 entered as servitor at Pembroke College, Oxford, where he became acquainted with the Wesleys, and

joined the small society which procured them the name of Methodists. Hearing of his devotional tendencies, Dr. Benson, bishop of Gloucester, made him an offer of ordination at 21, which he accepted, and he was ordained a deacon in 1736. Such was his powerful and exciting preaching, that, after his first sermon at Gloucester, a complaint was made to the bishop that he had driven several people mad; on which the prelate observed that he hoped the madness would not be forgotten before the next Sunday. He for some time supplied a curacy at Dummer, in Hampshire, but the next account sent him by the Wesleys of their progress in Georgia excited in him a desire to assist in their labors, and he arrived at Savannah in May 1737. Observing the deplorable want of education in the colony, he projected an orphan-house for which he determined to raise contributions in England, where he arrived in the beginning of 1739. Although discountenanced by many of the clergy, Bishop Benson did not scruple to confer on him priest's orders; and on going to London the churches in which he preached were incapable of holding the crowds assembled. He then adopted the practice of preaching in the open air, which he first carried out at Kingswood, near Bristol, among the colliers, on whom his discourses produced a surprising effect, and whose vicious manners and habits he visibly improved. He afterward preached in the open air in Bristol, and in Moorfields, Kennington, and other places in the neighborhood of London, to vast assemblages of people. In August 1739, he again embarked for America, and made a tour through several of the provinces, where he preached to immense audiences, with an effect vividly portrayed in the autobiography of Benjamin Franklin. He arrived at Savannah in January 1740, where he laid the foundation of the orphan-house, and after making another extensive tour, returned to England, in March 1741. During his absence his cause had been declining at home, and the differences between him and Wesley on the doctrines of election and reprobation deprived him of many followers. After visiting many parts of England, Scotland and Wales, where he married in 1741, he again returned to America (1744), and remained there nearly four years. His preaching met with great opposition in New England at this time and Harvard College put forth a "testimony" against him. Returning to England in July 1748 he was soon after introduced to the Countess of Huntington, who made him one of her chaplains. A visit to Ireland and two more voyages to America followed, and for several years his labors were unremitting. He preached at Exeter, N. H., the day before his death, and also at Newburyport. He is buried beneath the pulpit of the Federal Street Church at Newburyport. His works were published in 1771–72. Consult Gillies, 'Memoirs' (1772); Tyerman, L., 'Life of Whitefield' (1876–77).

WHITEFISHES, a name given in the United States to various species of salmonoid fishes of the genus *Coregonus* and sometimes to those of *Argyrosomus,* more properly designated ciscoes. *Coregonus* has a comparatively small and nearly toothless mouth, the premaxillary bones broad and with the edge nearly vertical, and the lower jaw short. The thin cycloid scales are much larger than in the salmons and trouts, and the caudal fin is deeply forked. Internally, the stomach is horse-shoe shaped and provided with very numerous pyloric caeca, and the swim-bladder is very large. The species, about 15 in number, though some ichthyologists recognize many more, are confined to the clear lakes of the northern portions of the northern hemisphere often extending into the Arctic regions and sometimes there becoming anadromous. Wherever found they are highly valued for food. North America has about eight species. The common whitefish (*C. clupeiformus*) has its centre of distribution in the Great Lakes, but extends into the various lake systems of New York and southern Canada. It reaches a length of two feet and may be distinguished from the related species by its numerous and long gill-rakers, the toothless mouth and the elevoted but not compressed back. As generally in the whitefishes, the color is olivaceous above and white below. It receives various local names from the fishermen, such as buffalo-back; and the variety landlocked in Otsego Lake at the head of the Susquehanna River is known as the Otsego bass. During the greater part of the year the whitefish remains in the deeper waters of the lakes, moving about in schools which change their feeding grounds with considerable regularity. Being toothless they feed only upon small animals, such as crustaceans, snails and insect larvæ, the first being by far the most important part of their diet. During the late fall and early winter the schools congregate on the shallows to spawn; in the act of spawning the female rises to the surface and is immediately followed by a male which mingles the sperm with the stream of eggs issuing from her vent. The eggs are about one-eighth of an inch in diameter and sink to the bottom, where most of them are eaten by the small fishes and mud-puppies which swarm on the spawning grounds. They develop slowly and require several weeks to hatch, the exact time depending upon the temperature of the water. Each female produces from 10,000 to 75,000 eggs, depending upon her size.

Besides the enemies affecting the eggs and young the adult whitefish are preyed upon by the large pike and lake-trout which follow the schools, and to a less extent by smaller predaceous fishes. The extensive development of the fisheries, which are prosecuted most vigorously at the very season when the spawning fish are most accessible on the shallows, has so depleted the numbers of the whitefish that the fisheries are now dependent upon artificial propagation for their maintenance. The methods are essentially the same as those employed in the artificial propagation of the shad, though many modifications in detail have been found necessary. Hundreds of millions of eggs are now annually taken and hatched under the auspices of the United States and State commissions of fisheries. Such extensive and even greater operations are required to sustain these fisheries at a point of production equal to satisfying the demand of the market. These figures represent the American catch alone and during the same year the Canadian fisheries prob-

ably yielded about 40,000,000 pounds more. Whitefish are sold fresh or are frozen immediately after capture and placed in cold storage at a temperature several degrees below freezing and in this condition shipped, especially during the winter, to all parts of the country. Relatively small quantities are also pickled or smoked.

Other species of *Coregonus* are found in the Great Lakes as well as in other lakes particularly northward and westward, but at the present time none are so highly valued as the common whitefish. An important one is the shadwaiter or round whitefish (*G. quadrilateralis*). The genus *Argyrosomus*, however, includes two species of great and increasing importance, though inferior in quality to the common whitefish. The genus differs from *Coregonus* chiefly in the projecting lower jaw, larger mouth and horizontal premaxillary bones. The numerous species are similarly distributed in North America, which has eight, Europe and Asia, and except for their great activity and predatory mode of life their habits in general resemble those of the true whitefishes. The cisco whiting or lake herring (*A. artedi*) is about a foot long, bluish or greenish above, with dark, speckled silvery sides. It abounds in shallow waters of the Great Lakes and, as indicated above, is of great commercial value. The moon-eye cisco (*A. hoyi*) has a very large eye and the sides are brilliantly silvery. It is about a foot long and is the object of a considerable fishery in the western part of Lake Michigan. It spawns in November in relatively deep water. A third important species of this genus is the blue-fin whitefish (*A. nigripennis*), distinguished from all of the preceding which have pale fins by the blue-black color of its pectorals, anals and ventral. It attains a length of 18 inches and is plentiful in the deep waters of Lake Michigan and the small lakes of Minnesota and Wisconsin and thence northwestward to Athabasca.

Whitefishes seldom take the hook, but are captured by means of pound, trap and gill nets and to a smaller extent with seines. The pound and trap nets are arranged in lines which sometimes reach to a distance of 10 or 12 miles from shore, while the gill nets are set much farther out in deep water and are weighted to the bottom.

Consult Brown Goode, 'Natural History of Aquatic Animals' (Washington 1884), and 'American Game and Food Fishes' (New York 1902); Townsend, 'Statistics of the Fisheries of the Great Lakes,' Report United States Fish Commission for 1901; and special papers of the United States Bureau of Fishes, and of the Canadian Fisheries Department.

WHITEHALL, London, England, a street leading from Parliament Square to Trafalgar Square, containing several public offices, and named after a palace that once stood there. The building known as the Horse Guards, the office of the commander-in-chief of the army, is so called in consequence of being the station where that part of the troops usually do duty. The treasury, near the Horse Guards, is built on the site of part of the old palace; the First Lord of the Treasury, however, has his official residence in Downing Street, where also the Cabinet meets. The Admiralty Office contains the offices connected with the administration of the naval affairs of the country. The original Whitehall succeeded a palace built by Hubert de Burgh before the middle of the 13th century. It afterward came into the possession of the archbishops of York, was inhabited by Wolsey (under the name of York Place), then passed to Henry VIII and was called Whitehall. Charles I was executed in front of Whitehall and he was led to the scaffold out of one of the windows. Oliver Cromwell died in Whitehall. In 1697 the building was destroyed by fire, except the banqueting hall, which had been added by James I, according to a design of Inigo Jones, in 1619. This portion still remains and chiefly consists of one room, of an oblong form and 40 feet high. The ceiling, representing the apotheosis of James I, was painted by Rubens and was retouched by Cipriani. This building was long a royal chapel, but it now contains the museum of the Royal United Service Institution.

WHITEHALL, Ill., city in Greene County, on the Chicago and Alton and the Chicago, Burlington and Quincy railroads, about 25 miles southwest of Jacksonville and 63 miles north of Saint Louis. It is in an agricultural and stock-raising region and in the vicinity are deposits of fire clay. The chief manufactures are flour, sewer-pipe, tiles, stoneware and machinery. Its shipping trade is chiefly in farm and dairy products, livestock and clay products. There are six churches, a high school and library. The two banks have a combined capital of $100,000. Pop. 2,854.

WHITEHALL, N. Y., village in Washington County, on Lake Champlain, Poultney River, the Champlain Canal and the Delaware and Hudson Railroad, about 75 miles north by east of Albany. It is at the foot of Skene's Mountain, in a narrow valley. It has railroad shops, silk and knitting mills, grist mills, lumber mills and machine shops. It has a high school and a library. The bank has a capital of $50,000 and deposits (1903) of nearly $700,000. The villge owns and operates the waterworks. The government is vested in a board of trustees and a president chosen annually by popular vote. In 1761 Whitehall was settled by Major Philip Skene and a colony of about 30 families; in November 1763 it was incorporated. When differences arose between America and England, which culminated in the Revolution, Skene joined the British and the Americans took possession of his property. An American garrison was stationed at Whitehall in 1776; but fearing capture by Burgoyne, they destroyed the fort and the houses, and abandoned the place. At the close of the war nearly all the people returned and claimed their former holdings. The whole of the Skene property was sold at auction, and the highest bidder gave £11 10s. In 1806 it was incorporated as a village. In 1812, when the Lake Champlain towns and villages were again near the centre of danger, a fort and block house was built. In 1819 the Champlain Canal was built from Whitehall to Fort Edward, and five years later it was extended to Troy. Pop. 4,666

WHITEHAVEN, England, a seaport and important coal-mining centre in Cumberland, situated on a bay of the Irish Sea, 40 miles

Chicago, Milwaukee and Saint Paul Railroad, about 46 miles southeast of Madison and 50 miles southwest of Milwaukee. It is in an agricultural and stock-raising region and has creameries, paper mill, wagon works, sash and door factories, flour mill, machine shops and furniture factory. It has a State normal school, a high school, opened in 1886, public and parish schools and a public library. There are two banks and a newspaper. Pop. 4,000.

WHITEWOOD. See LINDEN.

WHITFIELD, hwit'fēld, or **WHITFELD, Henry,** English clergyman: d. Winchester, England, about 1658. Of the date of his birth and his early life nothing is definitely known. He appears to have been appointed to the living of Ockley, Surrey, in 1616, but having protected several Puritan clergymen during the Laudian persecution incurred the displeasure of Laud, which was further increased by his refusal to read to his parishioners from the 'Book of Sports.' He, therefore, emigrated to New England in 1637 with many followers and was one of the founders of Guilford, Conn. In 1650 he returned to England and was minister at Winchester. His writings include 'Some Helpes to Stirre up to Christian Duties' (3d ed., 1636); 'The Light Appearing more and more toward the Perfect Day' (1641); and 'Strength out of Weakness' (1652).

WHITFIELD, Robert Parr, American geologist: b. New Hartford, N. Y., 27 May 1828; d. 1910. He studied natural history and geology almost unaided, was assistant on the New York State geological survey in 1856–76, and in 1872 was attached to the United States Geological Survey. He was instructor in geology at the Rensselaer Polytechnic Institute in 1872–75, professor in 1875–78 and for many years after 1887 was curator of the American Museum of Natural History in New York.

WHITGIFT, John, English prelate: b. Great Grimsby, Lincolnshire, about 1530; d. Lambeth, 29 Feb. 1604. He was educated at Pembroke Hall, Cambridge, and after the accession of Elizabeth took holy orders (1560) and was made chaplain to Cox, bishop of Ely. In 1563 he was appointed Lady Margaret professor of divinity at Cambridge, in which office he gained a high reputation by his lectures on the book of Revelations and the Epistle to the Hebrews, and in 1567 was elected master of Pembroke Hall. Soon after the queen made him her chaplain and master of Trinity College, Cambridge, and the same year he also became regius professor of divinity. He was made dean of Lincoln in 1571, and in 1576 bishop of Worcester, and, being also vice-president of the marches of Wales, made constant use of both the temporal and spiritual powers to put down Roman Catholicism and Puritanism within the limits of his jurisdiction. In 1583 he became archbishop of Canterbury, and soon exacted from every clergyman in the church a subscription to the three points of the queen's supremacy, the lawfulness of the common prayer and ordination service, and the truth of the whole 39 articles. Making use of the court of high commission he removed from positions in the church all non-conformists. In 1585 the star chamber, at his instigation, passed ordinances for the regulation of the press, by which no one was allowed to print except in London, Oxford and Cambridge; the number of printers was to be determined by the ecclesiastical commissioners; and none but a few special printers were to be suffered to print any book, matter or thing whatsoever until it should be perused and allowed by the archbishop of Canterbury and the bishop of London; and every one selling books contrary to the intent of the ordinance was to be imprisoned for three months. In 1586 he was sworn of the Privy Council and framed the statutes of cathedral churches. The hospital and grammar school at Croydon were founded by Whitgift. Consult 'Lives' by Strype (1718) and by Sir George Paule (1612); and Frere, W. H., 'The English Church of 1558–1625' (London 1904).

WHITING, hwī'ting, **Arthur,** American musician: b. Cambridge, Mass., 20 June 1861. He studied music in Munich at the Royal Music School with Rheinberger. He is a pianist and has composed orchestral and chamber music, as well as numerous songs, pianoforte pieces, concertos and sacred music. His series "University Concerts" have been well received at Harvard, Yale and Princeton and at other colleges.

WHITING, George Elbridge, American musician and composer: b. Holliston, Mass., 14 Sept. 1842. He early displayed musical talent and was engaged as an organist successively at Hartford, Conn., Boston and at Albany. He studied in Europe in 1863 and in 1872, was organist at the church of the Immaculate Conception, Boston, in 1876–78 and has occupied that position since 1883. In 1878–83 he was organist at the Cincinnati Music Hall and professor of organ and composition at the Cincinnati College of Music. He was engaged as a teacher in the New England Conservatory of Music for several years but resigned in 1897. His compositions include 'Grand Sonata'; 'Tale of the Viking'; 'Dream Pictures, Cantata'; 'Midnight, Cantata'; a one-act opera in Italian, 'Lenora' (1893); and numerous preludes, symphonies, etc.

WHITING, Lilian, American author: b. Niagara Falls, N. Y., 3 Oct. 1857. She engaged in journalism in Saint Louis, Mo., in 1876, in 1880–90 was literary editor of the Boston *Traveler* and was editor of the Boston *Budget* in 1890–93. Her published books are characterized by familiarity with occult subjects and a disposition to lead her readers unconsciously to recognize the genuineness of mysticism and spiritualistic teaching. They include 'From Dreamland Sent,' verse; 'The World Beautiful' (3 vols., 1894–96–98); 'Kate Field: a Record' (1899); 'The World Beautiful in Books' (1901); 'Boston Days' (1902); 'The Outlook Beautiful' (1905); 'Life Transfigured' (1910); 'The Brownings — Their Life and Art' (1911); 'Athens the Violet Crowned' (1913); 'The Lure of London' (1914); 'Women Who Have Ennobled Life' (1915); 'Canada the Spell-binder' (1917); 'The Adventure Beautiful' (1917).

WHITING, William Henry Chase, American Confederate soldier: b. Mississippi about 1825; d. Governor's Island, New York Harbor, 10 March 1865. He was graduated first in his class at the United States Military Academy

in 1845. He entered the engineering corps and was engaged in military construction work, reaching the rank of captain in 1858. He resigned from the army 20 Feb. 1861 and entered the service of the Southern Confederacy. He was chief engineer of the Army of the Shenandoah under Gen. J. E. Johnston in June and July 1862, holding the rank of major; and was promoted brigadier-general 27 Aug. 1861. He saw service at the first battle of Bull Run and at the battle of West Point, Va. He was promoted major-general in 1863, built Fort Fisher, N. C., and in 1864 was placed in command there. He was wounded and taken prisoner when Fort Fisher fell, 15 Jan. 1865, later dying from his wounds.

WHITING, Ind., town in Lake County, on Lake Michigan, and on the Pennsylvania Railroad, about 16 miles southeast of Chicago. It has a good harbor and steamer connections with the Lake Michigan ports. It has a large oil refinery, machine shops and several industrial establishments connected with refining and shipping petroleum and with shipping farm products. The manufacturing establishments, though small in number, are capitalized for over $15,000,000, and the value of the annual products is about $20,000,000. Pop. 6,587.

WHITING, a name applied to several quite unrelated fishes probably in allusion to the noteworthy whiteness of their flesh, or, in some cases, of the skin of the lower parts. In the United States, and more especially in the South, several species of *Menticirrhus*, a genus of *Sciænidæ*, are known as whiting, but more widely as kingfishes (q.v.). The common whiting (*M. americanus*) reaches a length of about a foot; the body is elongated and slender with a high spinous dorsal and a long low soft dorsal fin, an undulate caudal fin, and is completely covered with ctenoid scales; the outer row of teeth of the upper jaw are enlarged and strong and the color silvery gray with faint oblique dusky bars. It is very common along sandy shores of the entire Gulf Coast and on the Atlantic Coast northward to about the mouth of Chesapeake Bay and southward to Brazil. Though remaining on these coasts throughout the year they are most plentiful in summer when they frequent the bays and estuaries, but prefer strong currents and the deeper waters. They feed upon crabs, shrimps and other crustaceans, and being vigorous biters and gamy fighters afford splendid angling. Great numbers are caught on lines for the market and the flesh is unusually firm, delicate and well-flavored. Spawning is said to occur in May. The surf whiting (*M. littoralis*) is so called because, unlike the last, it frequents shallow waters along sandy shores and is captured in large quantities by means of seines. The outer teeth of the upper jaw are not enlarged; the gill-rakers are better developed than in the common whiting; and the black tip of the caudal fin is another mark of distinction. The common northern kingfish (*M. saxatilis*) also extends into southern waters and is there confused with the above species under the name of whiting. It may be recognized by its dusky color and the distinct, dark bands which cross the sides obliquely. Other species occur on the Pacific Coast. By the New England fisherman the name of whiting or silver hake is given to a common species of the cod family (*Gadidæ*), the *Merluccius bilinearis* of American ichthyologists, though many European authorities fail to distinguish it from the Old World *M. vulgaris*. From the great majority of the cods the whiting is distinguished by the total absence of a chin-barbel and by the peculiar excavated area of the top of the skull; the second dorsal and the anal fin are long and each divided nearly in two by a deep notch. The body is elongated and covered with small scales; the color grayish silvery white below. This whiting is common in waters of moderate depth along the shores of New England and somewhat northward, and extends southward in deep water to Virginia and even to the Bahamas. Unlike most of the *Gadidæ*, which are essentially bottom-feeders, it is an active, roving species, which comes to the surface to pursue and feed upon herring and other fishes. Sometimes large schools appear on our coasts and many are captured in purse-seines and pound-nets. Spawning takes place at the bottom on the edge of the continental slope. Owing to its comparatively small size and the softness of its flesh it is one of the least important economically of the family.

The European whiting (*M. vulgaris*) is scarcely distinguishable from the American, but has much smaller scales, fewer spines in the first dorsal fin and larger teeth. It frequents shallower water and is very abundant along the northern coasts of Europe. It makes its appearance in vast shoals, keeping at a short distance from the shore, and is taken by the line in great numbers. It is considered the most delicate and most wholesome of all the species of cod; but it does not attain a large size, usually not exceeding a foot in length and under two pounds in weight. The food of the adults consists chiefly of fishes and of the young of shrimps and other crustaceans. Spawning occurs in, and the young frequent, the shore waters. As long as the young feed chiefly on the bottom they retain a chin-barbel, but as their habits change this degenerates and finally disappears. Other fishes sometimes called whiting are the hog-fish, harvest-fish and a whitefish (q.v.).

WHITING, a preparation of white chalk from which the grosser impurities have been removed. It is extensively used in the arts, also for cleaning silver and making putty.

WHITLEY'S WORKSHOP COMMITTEES, or WHITLEY'S INDUSTRIAL COUNCILS. See WORKSHOP COMMITTEES.

WHITLOCK, Brand, American ambassador and author: b. Urbana, Ohio, 4 March 1869. He was engaged in journalism in Toledo, Ohio, in 1887–90, and was on the staff of the Chicago *Herald* in 1890–93. He was a clerk in the office of the Illinois secretary of state in 1893–97. He had meanwhile studied law and was admitted to the bar of Illinois in 1894 and to that of Ohio in 1897, then establishing himself in law practice at Toledo. He was elected mayor of Toledo in 1905 and served four successive terms, declining a fifth nomination. He succeeded in securing a new city charter providing for the initiative, referendum, recall and direct nominations. He was by this time a well-established magazine writer, producing both verse and prose, the latter dealing in the

main with politics and economics in an uncompromising fashion. He was appointed Minister to Belgium by President Wilson in 1913 and was in office at the outbreak of the European War. He was entrusted with the representation of seven of the warring nations, remaining at his post after the German invasion. His skill in dealing with the difficulties of the situation under the German occupation earned for him a worldwide reputation; and he won scarcely less praise for his handling of the Belgian relief work. The necessity for his leaving invaded Belgium when the United States declared war upon Germany in April 1917 was viewed with deep regret in Belgium. He refused to leave Brussels unless accompanied by the other Americans there, and crossed into Switzerland 4 April 1917. He later visited King Albert of Belgium at the battle front, and after the signing of the armistice in November 1918 he resumed his duties at Brussels. He returned to the United States for a visit in 1919, and while at home the country's representation in Belgium was raised to rank of an embassy, Mr. Whitlock thus becoming Ambassador. He is author of 'The Thirteenth District' (1902); 'Her Infinite Variety' (1904); 'The Turn of the Balance' (1907); 'Abraham Lincoln' (1908); 'The Gold Brick' (1910); 'On the Enforcement of Law in Cities' (1910–13); 'Forty Years of It: An Autobiography' (1914); 'Memories of Belgium Under the German Occupation' (1918); 'Belgium, A Personal Narrative' (1919), etc.

WHITLOCK, hwĭt'lŏk, Elizabeth Kemble, English actress, fifth child of Roger Kemble (q.v.): b. Warrington, Lancashire, 2 April 1761; d. 27 Feb. 1836. She first appeared at Drury Lane theatre in February 1783, as Portia. In 1785 she was married to Charles Edward Whitlock, a provincial manager and actor, and seven years later accompanied her husband to this country, where they performed for many years in the principal cities. Mrs. Whitlock became the most popular actress of the day in America, and in Philadelphia frequently performed before President Washington and other distinguished persons. She returned to England in 1807 with a competency and thenceforth retired from the stage. In personal appearance and voice she was said to have strongly resembled her sister, Mrs. Siddons.

WHITMAN, Charles Otis, American zoologist: b. Woodstock, Me., 14 Dec. 1842; d. 6 Dec. 1910. He was graduated from Bowdoin in 1868, studied at Leipzig, and in 1880–81 was professor of zoology at the Imperial University, Tokio, Japan. He was engaged in further studies at the Naples Zoological Station in 1882, and in 1883–85 was assistant in zoology at Harvard. He was director of the Allis Lake Laboratory, Milwaukee, in 1886–89, and in 1889–92 professor of zoology at Clark University, Worcester, Mass. He became director of the Marine Biological Laboratory at Woods Hole, Mass., upon its foundation in 1888, and from 1892 until his death was at the head of the department of zoology at the University of Chicago. He was elected to the National Academy of Sciences in 1895. He founded the *Journal of Morphology* in 1887, and after 1883 was editor of the microscopical department of the *American Naturalist*. He has made a specialty of the development of the vertebrates and of the structure and development of worms. His writings include 'Methods of Research in Microscopical Anatomy and Embryology' (1885); 'Biological Lectures' (1890–95); 'The Inadequacy of the Cell Theory of Development' (1893); 'Animal Behavior' (1898), etc.

WHITMAN, Charles Seymour, American lawyer: b. Hanover, Conn., 28 Aug. 1868. He studied at Amherst College and then studied law at New York University, and was admitted to the bar in 1894. In 1901 he was appointed assistant corporation counsel of New York City where his effective work won for him the post of city magistrate. In this capacity he founded the Night Court in that city for the immediate trial of all offenders arrested at night. In 1907 Governor Hughes appointed him a judge of the Court of Sessions, and in the following year deputy attorney-general in the investigation of election frauds in the northern part of the State. In 1909 he was elected district-attorney of New York City on a Fusion ticket. In this capacity he secured representation of the district-attorney's staff in the city magistrate's office, and was active in suppressing arson offenders. The noted Becker trial came up during his tenancy of office, and Whitman's mastery of the case was most effective in unearthing and reforming the relations between certain members of the New York City police and professional criminals. The handling of the Schmidt murder case, the prosecution of the poultry trust and of election frauds won for Mr. Whitman the highest commendation. He was renominated in 1913 and elected almost unanimously. In 1914 Whitman was elected to the governorship of New York State. His principal plank was the reformation of the State finances, which he proceeded to institute vigorously by a reorganization of State departments and a thorough investigation of the salaries of Civil Service employees. In 1916 he was elected chairman of the Republican National Convention, where he urged the nomination of Charles E. Hughes for President. In September of the same year he was re-elected to the governorship and established a precedent by sending to every enrolled voter a report of his first term as governor, containing also reports of the heads of other State departments. In connection with the European War, the governor ably supported the Federal administration in war policies and effectively mobilized the State's resources. He also inaugurated a State Constabulary, and a new State Guard to replace the National Guard on service in France. In 1918 he was again nominated for governor on the Republican ticket, but was defeated by Alfred E. Smith, the Democratic candidate.

WHITMAN, Frank Perkins, American physicist: b. Troy, N. Y., 29 July 1853. He was graduated at Brown University in 1874 and took his A.M. there in 1877, later studying at Johns Hopkins University. He was professor of physics at Rensselaer Polytechnic Institute, Troy, in 1881–86; and has since occupied that chair at Western Reserve University. He is a contributor to scientific periodicals.

WHITMAN, Marcus, American missionary and pioneer: b. Rushville, N. Y., 4 Sept. 1802; d. near Walla Walla, Ore., 29 Nov. 1847. After studying medicine at the Berkshire Medical Institution, Pittsfield, Mass., he practised in Canada for four years. He offered his services as a missionary (1834) to the American Board of Commissioners for Foreign Missions, and in 1835 went with Samuel Parker to explore the region of the Oregon, but did not go beyond Green River. In 1836, he married, with his wife and three fellow missionaries he set out to work among the Indians of the upper Columbia. The party crossed the plains by wagon, being the first white people to reach the Pacific Coast by this [illegible]. On 1 May they reached the Columbia River and located themselves near the site of the present Walla Walla, Wash. They were soon followed by a large number of emigrants, who settled in what was then known as Oregon, and now forms the States of Oregon, Washington and Idaho. At this time the Hudson Bay Company was using every possible means to secure this territory to the English. When this plan became evident to Whitman he decided to take every precaution to forestall it. The Ashburton Treaty was then before Congress, and was expected to settle the Oregon question. In 1842–43 Whitman traveled over 3,000 miles to the East on horseback, enduring all the hardships of a Western winter in the mountains, and according to the statement of H. H. Spalding, one of his missionary companions, he reached Washington (3 March 1843) only to find that the treaty had been signed, but that the Oregon question had not been included. Whitman, as Spalding's version represents, at once went to work to show the government the value of the land it had deemed worthless, demonstrated to the people the fertility of the soil of Oregon, and the fact that it could be reached by wagon, and then returned at the head of a large body of emigrants. By his daring ride and earnest endeavors Whitman, in this view of the matter, won this great section for the United States and the results of his work were secured by the treaty of 1846. This claim, however, has been the subject of much controversy, and to the satisfaction of some students has been disproved. Whatever its merits, there is no doubt that Whitman's ride (he reached Boston 30 March 1843) resulted in the reversal of the missionary board's purpose to discontinue the southern branch of the mission in which he was engaged; and his work and that of his companions has a historical relation to the American settlement of the Oregon country. Whitman, his wife, and 12 of their companions were massacred by the Cayuse Indians. Consult Nixon, 'Life of Marcus Whitman' (1895); Mowry, 'Marcus Whitman' (1901); and Bourne, 'Essays in Historical Criticism' (1901), in which the Whitman claims are examined and discredited; and Marshall, W. J., 'The Acquisition of Oregon and the Long Suppressed Evidence about Marcus Whitman' (Seattle 1911). See OREGON; OREGON QUESTION, THE.

WHITMAN, Sarah Helen Power, American poet: b. Providence, R. I., 1803; d. there, 27 June 1878. She was married to John W. Whitman, a Boston lawyer, was once engaged to Edgar Allen Poe, afterward writing a defense of him entitled 'Edgar A. Poe and His Critics' (1860); contributed numerous critical articles and poems to periodicals, and was noted for her conversational powers. Her verse was in part collected in the volume 'Hours of Life, and Other Poems' (1853), and fully in the posthumous 'Poems' (1879). 'Fairy Ballads' and some other works were written with her sister, Anna M. Power. Her finest poem, 'A Still Day in Autumn,' has much melody and beauty of expression and retains an honored place in anthologies.

WHITMAN, Walt (originally WALTER), American poet: b. West Hills, Long Island, N. Y., 31 May 1819; d. Camden, N. J., 26 March 1892. He was educated in the public schools of Brooklyn, and learned the printer's trade, after which he taught in country schools in Long Island. For a brief period he did editorial and reportorial work on newspapers, and in 1847–48 he made an extensive pedestrian tour as a workman through the United States and Canada, subsequently employing himself as a carpenter and builder. His first and chief work, 'Leaves of Grass,' was published by himself in New York in 1855. This thin volume of 94 pages was received, for the most part, with abuse, mainly because of its unconventional metrical style and the freedom with which the poet dealt with moral and social subjects. During the American Civil War, Whitman's brother was wounded on the battlefield, and the poet, who hastened to his aid, remained afterward as a volunteer army nurse at Washington and in Virginia for the years 1862–65. One result of this experience was the small volume 'Drum Taps' (1865), subsequently included with 'Leaves of Grass.' After the war he held a government clerkship in Washington, but the fatigue and mental strain of his labors in the hospitals brought about a severe attack of paralysis in 1873. He was recovering from this when the sudden death of his mother in his presence caused a serious relapse. From this time he resided at Camden, N. J., never securing robust health. During all these years Whitman wrote with the old vigor and freedom of rhythm, but with less of the early crudeness of expression. Though Whitman, like Carlyle and Browning, may be a dangerous and dangerously easy model for imitation, he undoubtedly worked out for himself a style of distinction as notable as theirs. This in itself is a title of fame, or at least a charm against oblivion, even though his literary style ran to extremes and vices. His evolved style was a rhythmic recitative or irregular chant, precursors of which may be found in the English translation of the Psalms and other Biblical poems, in Macpherson's 'Ossian,' and in the later poems of William Blake. These chants vary in movement and seem governed by laws rhythmic rather than metric, which (like the grammar of an unwritten tongue) have never been formulated even by the inventors themselves. They have a peculiar, wild, stirring charm, which is apt, for a time, to make regular verses seem tame and insipid. As to subject, Whitman set himself the Atlantean task of uplifting into the sphere or dominion of poetry the whole of modern life and man, omitting nothing, con-

cealing nothing. His thesis is that of Saint Peter's vision: "There is nothing common or unclean." Hence the logical necessity with Whitman to include the treatment of subjects which in modern society are tabooed as obscene and unmentionable; hence, too, the accusations of indecency, so evident and pertinent from the accuser's point of view, but so futile and irrelevant from that of the accused. Whitman was an idealist who bound himself by a solemn vow to be a thorough-going realist; and his resolute and often successful endeavor to secure this union gave his work its exceptional artistic quality. He was a prince of impressionists in literature. But so hard and high was the task that he set himself, that it is no matter of surprise that he sometimes, if not often, fails, and from heights where he was approaching the sublime, falls perilously near the ridiculous. This is the fate of all artists who strive for the highest things, that their failures — often only apparent — are more easily detected than their solid achievements; hence the contumely and ridicule that a Turner or a Wordsworth, Keats or Shelley suffers at the hands of a clever but uninitiated critic. So it was largely with Whitman; but it is better to approach him in the same spirit that he has shown toward man and nature, that of forever seeking for what was great and good, while outfacing steadily and bravely every stern and refractory reality. As the years roll on, Whitman's work is more highly esteemed. He had the true poetic fire, and was one of those who "talked with angels," and had glimpses of the life beyond. Several writers have contended that he was "illuminated," like Moses and Swedenborg. Besides the two books already mentioned, he published 'Drum-Taps' (1865); 'Memoranda During the War' (1867); 'Democratic Vistas' (1870); 'Passage to India' (1870); 'After All, Not to Create Only' (1871); 'As Strong as a Bird on Pinions Free' (1872); 'Two Rivulets' (1873); 'Specimen Days and Collect' (1883); 'November Boughs' (1885); 'Sands at Seventy' (1888); and 'Goodbye, My Fancy' (1892).

The *Conservator*, of Philadelphia, is the organ of Whitman study. Consult 'Autobiographia,' selected from the poet's writings (1902); Bazalgatte, Leon, 'Walt Whitman — The Man and the Artist' (Garden City, N. Y., 1919); Burroughs, 'Whitman as Poet and Person' (1866); Buche, authorized 'Life' (1883); Burroughs, 'Whitman: A Study' (1896); Harned, Thomas B., (ed.) 'Letters of Anne Gilchrist and Walt Whitman' (1918); O'Connor, 'The Good, Gray Poet' (1866); Dowden, 'Studies in Literature' (1878); Symonds, 'Essays, Speculative and Suggestive' (Vol. II, 1890); Shay, 'Walt Whitman, Bibliography' (New York 1916).

WHITMAN, Mass., town in Plymouth County, on the New York, New Haven and Hartford Railroad, about seven miles east of Brockton and 20 miles south by east of Boston. The chief manufacturing establishments are boot and shoe factories, paper and wood box factories, tack and nail works and steel shank factory. Whitman has 65 manufacturing establishments, employing about 2,500 persons, with annual products of over $6,000,000. It has seven churches, public schools and a public library. There are two banks, one national and one savings bank. The government is administered by annual town meetings. The town was originally a part of Abington, but was set off in 1875 and incorporated as South Abington. In 1886 the present name was adopted. Pop. 2,972.

WHITMAN COLLEGE, located at Walla Walla, Wash. It was founded by Cushing Ells as a memorial to Marcus Whitman (q.v.); it was chartered in 1859 as Whitman Seminary, but was not open to students till 1866; in 1882 the courses were extended, the standard raised and a new charter obtained in 1883 by which the name was changed to Whitman College. Women are admitted on equal terms with men students. The organization includes in addition to the College Department, the Conservatory of Music and the Academy. The college confers the degrees of bachelor of arts, bachelor of letters, bachelor of science and bachelor of music. Certain studies, including Biblical literature, are required for all courses; Greek is required for the H.B. degree, French or German for the B.L. and B.S. degrees, and one year's work in theory of music, history of music, harmony and counterpoint for the music degree. Each student by the end of the freshman year must elect a major study in which three years' work must be done; the major for the B.S. degree must be in mathematics or a science. The rest of the required number of hours are free electives. Courses in pedagogy are included in the curriculum. Practical music work does not count toward a degree in the above-mentioned courses; but in the conservatory the degree of bachelor of music is conferred on students who hold a bachelor's degree and complete the regular music course. There are 20 scholarships and one loan fund; students are aided in securing employment. The students maintain Christian associations, literary societies and an oratorical association, glee clubs, athletic associations and a general organization known as the "Associate Students"; the college is affiliated with the Inter-Collegiate Debating Association and the Inter-Collegiate Athletic Association. The campus consist of 27 acres near the centre of the city and includes a small lake. The buildings include the Whitman Memorial, Billings Hall (men's dormitory), Reynolds Hall and Prentiss Hall (women's dormitories), Association Hall, the conservatory and the gymnasium. The library in 1917 contained 27,000 volumes; the students numbered 495, and the productive funds totaled $684,044.

WHITMARSH, Hubert Phelps, American journalist: b. Madoc, province of Quebec, 10 Aug. 1863. He was a druggist in New York and Boston in 1887–1900, and in the latter year became the representative of the *Century* in Cuba. He subsequently went to the Philippines for the *Outlook* and in 1900–01 was governor of Benguet, P. I., resigning in the last-named year. He has published 'The World's Rough Hand'; 'The Golden Talisman'; 'Mysterious Voyage of the Daphne'; 'The Young Pearl Divers,' etc.

WHITNEY, hwit'ni, **Adeline Dutton Train**, American author: b. Boston, Mass., 15 Sept. 1824; d. Milton, Mass., 21 March 1906.

the leader of the Conservative Opposition; and from 1905 until his death he was Premier of Ontario. He was knighted in 1908.

WHITNEY, Josiah Dwight, American geologist, brother of W. D. Whitney (q.v.): b. Northampton, Mass., 23 Nov. 1819; d. Lake Sunapee, N. H., 18 Aug. 1896. He was graduated at Yale in 1839, and spent the years 1842–47 in study in Europe, and then explored, with J. W. Foster, the Lake Superior region. Their 'Synopsis' of the explorations was published in 1849 and their 'Report' on the geology, 1850–51. He was appointed State chemist and professor in the Iowa State University in 1855 and State geologist of California in 1860. He labored on the survey of that State till 1874, publishing his 'Geological Survey of California' (1864–70). In 1865 he was appointed to the chair of geology at Harvard. Among his publications not already named are 'The Metallic Wealth of the United States' (1854); 'Yosemite Guidebook' (1869); 'Contributions to American Geology' (1880); 'Studies in Geographical and Topographical Nomenclature' (1888). The highest peak of the Sierra Nevada was named Mount Whitney (q.v.) in his honor.

WHITNEY, William Collins, American capitalist and politician: b. Conway, Mass., 15 July 1841; d. New York, 2 Feb. 1904. He was graduated at Yale in 1863, and at the Harvard Law School in 1865; studied law with Abraham R. Lawrence in New York, and was admitted to the bar in that city. He took an active part in the organization of the Young Men's Democratic Club, and in the proceedings against the "Tweed Ring"; served as corporation counsel of the city in 1875–82, thoroughly reorganizing the law department; and was secretary of the navy in the Cabinet of President Cleveland from 1885 to 1889. In this position he accomplished much in the development of plans for strengthening the naval service, and the "new navy" owes its subsequent increase in considerable part to his progressive policy. He did effective work for the election of Grover Cleveland as governor of New York in 1882, and as President in 1884, and again in 1892, when he was manager of the Democratic campaign. He declined to enter the Cabinet again, preferring to pursue his business career, in which his interests had grown to great proportions. One of his largest enterprises was that which resulted in the consolidation of the various street railway lines in New York City. The Metropolitan Street Railway system was mainly organized by him, and he was a director in many corporations and societies. He was also a man of recreations, was especially interested in the breeding and training of horses, and became the recognized leader of the American turf, for the elevation of which to higher levels of sportsmanship he successfully strove. At the time of his death he was one of the largest landowners in the East, his holdings being in several States, and including a game preserve of 16,000 acres in the Adirondacks. While his main residence was in New York, he also maintained others on his various estates, North and South, as well as a house in London. He left two sons, Harry Payne Whitney and Payne Whitney.

WHITNEY, William Dwight, American philologist, brother of J. D. Whitney (q.v.): b. Northampton, Mass., 9 Feb. 1827; d. New Haven, 9 June 1894. He was graduated from Williams College in 1845, studied at Yale in 1849–50, and then went to Germany, where he continued his philological and Sanskrit studies under Bopp at Berlin and Roth at Tubingen. He was appointed to the professorship of Sanskrit at Yale in 1854, and in 1870 he received in addition the chair of comparative philology, posts which he retained till his death. In 1856 he published, with Roth, an edition of the Atharva-Veda Sanhita, and in 1862 issued at New Haven an edition, with translation and notes, of the 'Atharva-Veda Prâtiçâkhya.' His 'Language and the Study of Language' (1867) was an admirable exposition of the main principles of comparative philology. His other published works include 'A Compendious German Grammar' (1869); 'A German Reader' (1869); an edition of the 'Taittiriya-Prâtiçâkhya' (1872), for which he was awarded the Bopp medal of the Berlin Academy; 'Oriental and Linguistic Studies' (1872); 'The Life and Growth of Language' (1875); 'Essentials of English Grammar' (1877); 'A Sanskrit Grammar' (1879); 'The Roots, Verb Forms, and Primary Derivatives of the Sanskrit Language' (1885), a supplement to the grammar; 'A Practical French Grammar' (1886), etc. He was a contributor to Böhtlingk and Roth's great 'Sanskrit Dictionary' (1853–75) and editor-in-chief of 'The Century Dictionary of the English Language' (1889–91). He was elected a member of the American Oriental Society in 1850 and wrote more than half of the contents of Vols. 6–12 of the 'Journal' of that society. For a complete bibliography of his work, consult the 19th volume of the 'Journal of the American Oriental Society' (1897).

WHITNEY, Willis Rodney, American chemical engineer: b. Jamestown, N. Y., 22 Aug. 1868. He was graduated at the Massachusetts Institute of Technology in 1890 and took his Ph.D. at the University of Leipzig in 1894. He was appointed non-resident assistant professor of theoretical chemistry at the Massachusetts Institute of Technology in 1904, and non-resident professor in 1908. Since 1904 he has been director of the research laboratory of the General Electric Company, Schenectady, N. Y. Among other results of his research work may be mentioned the perfecting of the metallic electric lamp filaments and the development of wrought tungsten. He was president of the American Chemical Society in 1910 and received its Willard Gibbs Medal in 1916. He was also president of the Electrochemical Society in 1911; and was appointed to the Naval Consulting Board in 1915. He is author of many papers in technical magazines and translator of Le Blanc's 'Electro-Chemistry' (1896).

WHITNEY, Mount, a peak of the Sierra Nevada, in the southeastern part of California; altitude, 14,522 feet. It is the highest elevation in the United States, outside of Alaska. On the east side the slope is precipitous, rising abruptly from Owens Valley about 11,000 feet. In 1881 Prof. S. P. Langley remained for some time on the summit, making daily observations on the solar heat.

WHITNEYITE, a metallic mineral, containing 88.4 per cent of copper and 11.6 per cent of arsenic and having the formula Cu_3As. It is

He was less cosmopolitan than Longfellow, but by many critics has been ranked as not greatly inferior to that poet. Consult the biographies by Underwood (1875; new ed., 1883); Kennedy (1882); Linton (1893); Pickard (1894; the authoritative 'Life and Letters'); Barton (1900; 'Beacon Biographies'), and Carpenter, G. R. (1914). Also Fields, 'Whittier: Notes of His Life and His Friendships' (1893); Claflin, 'Personal Recollections of John G. Whittier' (1893); Pickard, 'Whittier as a Politician' (1900) and 'Whittier Land' (1904); Stedman, 'Poets of America' (1886), and Eastburn's 'Whittier's Relation to German Life and Thought' (Philadelphia 1916).

WHITTIER, Cal., city in Los Angeles County, 15 miles southeast of Los Angeles, on the Southern Pacific Railroad. The city was founded as a Quaker colony in 1887. Whittier College is located here. The surrounding district produces oil, walnuts and citrus fruits. Pop 4,550.

WHITTINGHAM, hwit'ing-ham, **William Rollinson**, American Protestant bishop: b. New York, 2 Dec 1805; d. Boston, 17 Oct. 1879. He was graduated at the General Theological Seminary, New York, in 1825, ordained deacon in 1827, and priest 1829, and was in charge of Saint Mark's Church, Orange, N. J., until 1831. He then became rector of Saint Luke's, New York, and in 1835 was professor of ecclesiastical history in the General Seminary, which position he held until his consecration as bishop of Maryland in 1840. In this office he commanded universal respect by the fullness and breadth of his scholarly attainments. He was generally recognized, especially in the historical field, as the most learned prelate in his communion. A convinced but fair and chivalrous controversialist, he advocated the principles of his faith in such a way as to win adherence to them in all parts of the country. The written evidence of his learning is, however, preserved principally in the pages of various periodical publications, such as *The Churchman*, of which one time he was editor. During the Civil War, in opposition to many of the people in Maryland, he was unflinching in his advocacy of loyalty to the Federal government.

WHITTINGTON, hwit'ing-tŏn, **Richard**, English magistrate: b. Pauntley, Gloucestershire, about 1359; d. London, March 1423. He became a mercer in London, a member of the common council in 1385 and 1387, subsequently alderman and sheriff, and mayor in 1397–98, 1406–07 and 1419–20. He was very liberal in charitable gifts. The legend which represents him as making his fortune by sending a cat in an outgoing ship to Barbary, where it was sold for a large sum, and as returning to London, which he had just quitted on hearing Bow bells sounding what seemed to be

> "Turn again, Whittington,
> Lord Mayor of London."

is without foundation; though it is treated as fact in the uncritical 'Lives' by Lysons (1860) and Besant and Rice (1881; 2d ed., 1894). Consult Clouston, 'Popular Tales and Fictions' (1887) and Wheatley's edition (for the Villon Society) of the 'History of Sir Richard Whittington' by T. H. (1885).

WHITTLESEY, hwit'l-sĭ, **Charles**, American geologist: b. Southington, Conn., 4 Oct. 1808; d. Cleveland, Ohio, 1886. He was graduated from West Point in 1831, served in the Black Hawk War of 1832 and resigned from the army in that year. He was admitted to the bar and engaged in law practice at Cleveland, where he was on the editorial staff of the *Herald* in 1836–37, and in 1837–38 was engaged in the Ohio State geological survey. He was occupied in making a mineralogical and geological survey of the Lake Superior and upper Mississippi regions for the United States government in 1847–51, and in 1858–60 was attached to the Wisconsin geological survey. On 17 April 1861 he was appointed assistant quartermaster-general in the staff of the governor of Ohio, and in the western Virginia campaign served as chief engineer of the Ohio troops. He was appointed colonel in August 1861 and was subsequently chief engineer of the Department of the Ohio. He led his regiment at the battle of Fort Donelson and at the battle of Shiloh was in command of a division. Failing health compelled his resignation in 1862 and he resumed his surveys in the Lake Superior and upper Mississippi regions. He was one of the founders in 1867 of the Western Reserve Historical Society of Cleveland and was for many years its president. His writings include more than 200 titles. Among them are 'Description of Ancient Works in Ohio' (1851); 'Ancient Mining on the Shores of Lake Superior' (1863); 'Early History of Cleveland and Vicinity' (1867), etc.

WHITTREDGE, hwit'rĕj, **Worthington**, American artist: b. Springfield, Ohio, 22 May 1820; d. 1910. He studied art in Cincinnati, worked there as a portrait-painter 1842–49, later went to Europe and studied under Andreas Achenbach at Düsseldorf, also in Paris, Belgium, Holland and Rome, returning to the United States in 1859, to become noted as a landscape painter, his chief subjects being drawn from American scenery. Accompanying General Pope on a tour of inspection at the West in 1874, he sketched many Rocky Mountain views. He was president of the National Academy of Design in 1875–76. His chief works include 'House on the Hudson River' (1863, in the New York Public Library); 'Old Hunting Ground' (1864); 'View of the Rocky Mountains from the River Platte' (1868); 'Trout Brook' (1875); 'Camp Meeting' (1906, in the Metropolitan Museum), etc.

WHITWORTH, hwit'wĕrth, **Sir Joseph**, English mechanical engineer: b. Stockport, 21 Dec. 1803; d. Monte Carlo, Italy, 22 Jan. 1887. He worked as a mechanic in Manchester and London, discovered the method of making a truly plane surface, and in 1833 established himself as a tool-maker at Manchester. Between 1840 and 1850 he developed his measuring-machine, by means of which he elaborated his standard system of uniform measures and gauges which was found by engineers to be of great usefulness. One of his devices which proved to be of much immediate service was that of a uniform system of screw-threads. He made many experiments in connection with rifles, and in 1857 perfected a hexagonal-barreled rifle of great range, accuracy and pene-

trative power, highly excelling the Enfield, then largely in use. It was not accepted at the time by the War Department, as being of a calibre too small (4.5) for a military weapon; though in 1869 the War Office declared that a weapon of such calibre would appear to be the most suitable. He was equally successful in the building of cannon, but his rifled gun with a 250-pound shell and a six-mile range, was rejected by the ordnance board in 1865, greatly to the detriment of British ordnance. His invention of compressed cast steel for ordnance was an important one, and came into general use. His works at Manchester were converted into a limited liability company in 1874, and in 1897 united with the Elswick works, established by Sir William Armstrong (q.v.). His fortune was devoted to the endowment of 30 scholarships in mechanics and to the furthering of charitable and educational work. He was made a baronet in 1869. Among his writings were 'The Industry of the United States in Machinery, Manufactures and Useful and Ornamental Arts' (1854) and 'Miscellaneous Papers on Mechanical Subjects' (1858). Consult the memoir in the 'Proceedings' of the Institution of Civil Engineers, Vol. XCI (1887–88).

WHITWORTH GUN. See ORDNANCE.

WHITWORTH SCHOLARSHIPS, certain scholarships established in England in 1869 by Sir Joseph Whitworth, to encourage the cultivation of combined theoretical and practical skill in the industrial arts of mechanics and engineering. They were placed by the founder under the charge of the English council of education, and are open to be competed for by any young man not 26 years complete, and who has been engaged in handicraft in the workshop of a mechanical engineer for at least three years. There are now four scholarships annually competed for of the value of $500, tenable for three years, besides exhibitions tenable for one year, value $250 and $400.

WHOLE FAMILY PROTECTION. See INSURANCE, FRATERNAL.

WHOOPER, the whooping swan. See SWAN.

WHOOPING-COUGH. See HOOPING-COUGH.

WHOOPING CRANE. See CRANE.

WHORTLE-BERRY. See VACCINIACEÆ.

WHYDAH, hwid'ä, French West Africa, a seaport town of Dahomey, on a lagoon communicating with the Bight of Benin, about 70 miles south of Abomey. It has a considerable trade in palm-oil. Pop. about 15,000.

WHYDAH-BIRD, WHIDAH-BIRD, or WIDOW-BIRD, a weaver-bird (q.v.) of the West African subfamily *Viduinæ*, in which the tail-feathers are greatly prolonged and modified. The paradise whydah-bird is brownish-black, the head, chin and throat being black and the neck encircled by a brown collar. The under parts are pale brown. The tail is long and the two central feathers are elongated and possess broad webs at the tip and a slender shaft, while the two next feathers are about 11 inches long and are broadly webbed. The other tail feathers are set vertically. This species attains a length of five or six inches, exclusive of the tail feathers. The nest is said to be ingeniously made of cotton fibres and to be divided into two compartments, in one of which the female sits on the eggs, the other being occupied by the male bird. The shaft-tailed whydah-bird (*V. regia*) is colored a rusty red on the head and neck, the back of the head and crown being black. The average length of this species is eight or nine inches, and the four central feathers are elongated, but consist each of the bare shaft or quill only, a slight web existing at their tips. Consult Newton, 'Dictionary of Birds' (New York 1896).

WHYMPER, hwim'pėr, **Edward,** English author and traveler: b. London, 27 April 1840; d. 1911. He was educated privately, and in 1860 was sent by a London firm to make sketches of Alpine peaks. He ascended Mount Pelvoux in the French Alps in 1861, the Pointe des Ecrins in 1864 and in 1865 the Matterhorn. He visited northern Greenland in 1867 and in 1872, making valuable discoveries in evidences of a previous abundant rich vegetation there, his collection of specimens being now a part of the collection of the British Museum. In 1879–80 he explored the Andes in Ecuador, discovered the Andean glaciers, and succeeded in ascending Chimborazo, a feat which Humboldt attempted and had failed to accomplish. In 1901 he made an exploring tour of Canada, ascending mountains and making investigations in the region of the "Great Divide." His publications include 'Scrambles Among the Alps in the Years 1860–69' (1871); 'Travels Among the Great Andes in the Equator' (1892); 'Zermatt and the Matterhorn' (1897), and 'Chamonix and Mont Blanc' (1896). The two latter are reprinted almost every year for sale to tourists.

WHYTE, Alexander, clergyman of the Free Church of Scotland: b. Kirriemuir, Forfarshire, Scotland, 13 Jan. 1837. His education was received at the University of Aberdeen and at New College, Edinburgh. He was assistant minister of Free Saint John's, Glasgow, 1866–70; assistant minister, 1870–73 and minister, 1873–1909 of Free Saint George's, Edinburgh. Since 1909 he has been professor of New Testament Literature and principal of New College, Edinburgh. He is the author of 'A Commentary on the Shorter Catechism' (1882); 'Bunyan Characters' (4 series, 1893–1908); 'Samuel Rutherford and some of his Correspondents' (1894); 'Jacob Behmen; An Appreciation' (1894); 'Lancelot Andrewes and His Private Devotions' (1895); 'Four Temperaments' (1895; later ed., 1910); 'Bible Characters' (6 vols., 1896–1902); 'Saint Teresa: An Appreciation' (1897, 1910); 'Father John of the Greek Church' (1898); 'Sir Thomas Browne: an Appreciation' (1898); 'Characters and Characteristics of William Law' (1898); 'Newman: an Appreciation' (1901); 'Bishop Butler: an Appreciation' (1903); 'The Apostle Paul' (1903); 'Walk, Conversation, Character of Jesus Christ Our Lord' (1905); 'Thomas Shepherd, Pilgrim Father and Founder of Harvard' (1909); 'Thirteen Appreciations of Old Time Divines, Mystics, and Churchmen' (1914).

WHYTE-MELVILLE, hwit'mel'vil, **George John,** British novelist: b. Fifeshire, Scotland, 19 June 1821; d. Vale of Aylesbury,

and a beautiful public library. The city has a very efficient motorized fire department, an adequate system of waterworks and a modern sewage system. The natural gas supply is sufficient for domestic use. The park system is the largest and most beautiful in the State. There are 18 State banks and four national banks. Oil was discovered 20 miles east of Wichita in 1914. During the year 1917 the average daily output from this field was 150,000 barrels. The discovery of oil led to the investment of $30,000,000 in refineries in Wichita. Since April 1917, Wichita has been governed by a board of five commissioners who chose a city manager to execute the laws and ordinances and to appoint the heads of all departments and all subordinate officers. The public schools consist of six years' work in the elementary schools, three years in the intermediate schools, three years in the high school. There are 31 buildings and 375 teachers. The net funded debt is $1,363,277; the total realty assessed valuation $85,000,000, which is 85 per cent of the market value. The tax rate per $100 valuation is $1.80. Pop. 75,000.

WICHITA FALLS, Tex., city and county-seat of Wichita County, situated in the northern tier of Texas counties, about 20 miles south of Red River, on the Fort Worth and Denver City, the Missouri, Kansas and Texas, the Wichita Valley, the Wichita Falls and Southern, the Wichita Falls and Northwestern and the Wichita Falls and Oklahoma railroads. Wichita Falls is the most important city adjacent to the new and rapidly developing oil fields of Texas. It is only 15 miles from the Burkburnett field, 11 miles from Iowa Park, 26 miles from Electra and is connected with these fields by railroads. It is 85 miles from the Stephens County fields and 100 miles from the Ranger fields. There are 10 oil refineries now operating in Wichita Falls, Burkburnett, Electra and vicinity, with as many more under construction or contemplated. This city is headquarters for the oil fraternity of this entire section. The city has more than 45 manufacturing plants, exclusive of oil refineries, with a total investment of more than $6,000,000, and an annual gross output of about $20,000,000. Among the articles manufactured here are motor trucks, window glass, glass fruit jars, sashes and doors, etc. The Wichita Mill and Elevator Company, one of the most complete plants of the kind in the South, costing three-fourths of a million dollars, does an enormous domestic and export business. Wichita Falls is the distributing and jobbing centre of a large section of North Texas and Southern Oklahoma. Wichita Falls has an estimated population (June 1919) of 40,000. The city is growing perhaps more rapidly than any city of the South. While the enormous increase in population in so short a time has added a gigantic task upon the city, facilities are rapidly becoming adjusted to new conditions. A new eight-story hotel to cost approximately $1,000,000; two 10-story buildings, one six-story building and 30 smaller business buildings are being erected. A bond issue of $1,500,000 for permanent public highways was voted recently in the county, and this money is to be expended for good roads as rapidly as possible. Nearly $1,000,000 is to be spent in the near future for additional street paving and civic betterment. Besides the recent county road bond issue other available road money will bring the total county and city expenditure for highways to about $3,000,000. It is planned to have the most elaborate and imposing rural highway system in the Southwest. There are five strong, growing banks with total deposits of $25,000,000 and clearings of $83,209,758 for the period from 1 Jan. 1919 to 14 June 1919. Total bank deposits for this city are exceeded by only six Texas cities. Annual postal receipts now approximate $180,000, or an increase of more than 150 per cent in 12 months. The assessed valuation exceeds $20,000,000, while the real value of the city property exceeds $50,000,000. Wichita Falls is a city of homes, schools and churches. There are 25 imposing edifices of worship representing all the leading denominations and faiths. Kemp Public Library, a gift to the citizens from one of Wichita Falls' leading builders, is one of the most complete library buildings in the State and contains an excellent selection of the best literature. Wichita Falls has a modern and efficient system of public schools, and $100,000 was expended in 1919 for additional buildings. The State of Texas is expending $750,000 in the erection of one of its eleemosynary institutions located on the shore of Lake Wichita about four miles from the city.

HUBERT M. HARRISON,
Secretary Wichita Falls Chamber of Commerce.

WICHITA INDIANS. One of the southern tribes of the Caddoan linguistic stock of North American Indians whose traditional home was the Wichita Mountains of Oklahoma, near which their reservation now lies. In the first half of the 19th century their principal village was on the north fork of Red River, a short distance below the mouth of Elm Creek, in Oklahoma, but three centuries ago (in 1541) Coronado found them in Kansas, between the Arkansas and Kansas rivers, in what the Spaniards designated the province of Quivira (q.v.) The typical house of the Wichitas is the grass lodge; they were always agriculturists, and formerly practised tattooing, from which custom and from their resemblance to their congeners, the Pawnees, they are called by the French *Pani Piqués*. They are now under the Kiowa agency in Oklahoma, where, with their subtribes, the Tawakoni and Waco, they number more than 300.

WICKER WEAVING AND PRODUCTS. The predecessor of all arts, the most universal art and the least changing art in the realms of history is wicker weaving. True, there have been changes in the commodities used for weaving and changes in the articles made by weaving, but the actual method of weaving wicker strands has passed down from the very earliest days of mankind with marked uniformity. Weaving in its general sense — including that of textiles as well as wicker — is considered by historians and biblical students as the oldest of arts, but when the general subject is studied it is found that wicker weaving even precedes all other processes. Just when it was born and by whom created is impossible to say. Some biblical students contend that Eve, following her great sin, wove a skirt of twigs and leaves through an endowed art. Other equally studious students assert that

Eve and her fellow biblical personages learned the art of weaving by viewing the interlacing growths of tree limbs and noting the protection resulting therefrom. Still more assert that the art became known by persons through watching and adopting methods used by birds in weaving their nests or spiders and other insects in weaving their webs. Whatever caused human intelligence to grasp the art of weaving may never be known, but that it is the earliest art is taken as an established or accepted fact. Actual biblical evidences showing an early knowledge of weaving are found in Exodus xxviii, 32, where it relates that bindings were made of woven work. The same book, xxxix, 22, says that robes were made by weaving. Exodus ii, 2, tells of an ark (basket) being woven of papyrus reed and Moses set adrift in it on the river Nile. Biblical commentaries also add that boats, sails, mats and ropes were made by weaving. There are other Bible references to weaving, thus indicating that the art, so far as wicker-work is concerned, was well known in those days. Historians, here and there, speak further of wicker weaving although they do not specifically use the word "wicker." The word has long been understood, however, as perfectly proper in classifying all materials used in the weaving of furniture, baskets and baby carriages. Modern dictionaries define "wicker" as (1) "a pliant young shoot or rod; twig; osier; withe; as, a willow wicker; (2) ware made of wicker work; (3) a wike; mark." "Wicker-work" is defined as "a fabric or texture, as a basket, of woven or platted osiers, withes or twigs; basket work, as a chair of wickerwork." Since the accepted meaning is so broad it is quite easy to trace wicker weaving down through the many ages to the present day although there is a surprising lack of written information on the entire subject. It is known that practically every race of human beings has been familiar with the art of wicker weaving, for in the history of all races there are references to woven bags, baskets, roofs, floors, furniture, etc. And yet with all this great age and universal use we find that wicker weaving (no textile weaving) has remained as it began — a slow hand vocation in which the strands have been woven about a frame. That is, the development has remained unchanged until 1916, when Marshall B. Lloyd of Menominee, Mich., invented and put into practical use a new method for weaving wicker and a loom which weaves the strands into shapes desired.

Commodities.— Biblical data shows that the first wicker weaving was done by using natural leaves and twigs, interlacing them at right angles in just the same manner as modern hand weavers work with their more modern commodities. Then came heavier pieces of wood as is indicated in 2 Kings xxiii, 7, which says, "women weave hangings from the grove." Whether this means limbs of trees or vines hanging from trees is unknown although the latter is the accepted version. Exodus ii, 2, specifically states the ark (basket) of Moses was woven of papyrus reed just as were boats, sails and other articles. Mediæval days find the willow branch popular for wicker weaving. It has remained so to the present day although the scarcity of it and the growing demand for woven work in general has made it necessary, as well as wise, for manufacturers to turn to other forms of wicker. Rattan has been most generally used in making wicker articles during recent years. It is a vine growing in India, China, South Africa and elsewhere in the Orient. It was first used as ballast for vessels returning from the Orient. When the rattan reached America it was burned as firewood or waste. A man named Wakefield, during the days of the hoopskirt, found that rattan would lend itself to the manufacture of hoops. This led to its becoming prominent in the manufacture of woven furniture and bodies for baby carriages. Rattan is usually known as reed when used for these purposes. The rattan vine is harvested by natives, then cured and classified as to size and texture. The bark is removed and treated, thus becoming "cane" and used most extensively as seats for chairs, davenports and the like. The wood part of the rattan vine inside the bark is also treated and the finished product is known as "reed." While being woven, reed is kept in water so as to make it pliable. If it is not soaked the reed will not bend without breaking, and despite its extensive use the article gives only limited satisfaction owing to its brittleness. The most recent form of wicker is a fibre made from paper. Just whether it

WICKER BABY CARRIAGE OF THE CLOSING YEARS OF THE 19TH CENTURY.

The running gear is practically the same as that of to-day. The body is woven loosely of flat reed and with as little wicker-work as possible because of the extreme cost of hand weaving.

should be classified as a textile or wicker has not been established. It is manufactured much like a textile (see TEXTILE INDUSTRY) and is used very extensively as a wicker and a textile. It, however, quite naturally fits in under the wicker classification. The lack of willow and the dissatisfaction over reed has long caused baby carriage, furniture and basket makers to seek a new article. The World War of Europe, perhaps, had most to do with the discovery of paper and its adaptability to textile and wicker-work. During the war there arose an amazing lack of clothing, bags, cordage and other articles of this nature. The strength of paper, which has long been used in railway car wheels, its pliability and other abilities to be treated chemically, so that when completed it can resist weather conditions without injury, evidently turned the human mind to paper. Tests have proven that a piece of twisted paper gauging $\frac{1}{1000}$ of an inch is stronger than any known steel of the same weight. Experiments have proven that certain hard or tightly-twisted paper $\frac{1}{1000}$ of an inch in diameter will not break unless the tension is more than 50 pounds, while the same thickness of reed will not stand a strain of 13 pounds. G. L. Brownell made the first real paper-twine machinery 17 Dec. 1895. Gradually the use of twisted paper as a textile became general in the manufacture of clothing, bags, cordage, belts, caps, hats, braces and leather substitutes. Then it spread to wicker-work, where it finds its most adaptable place. Germany and Austria have made tremendous strides in the paper-fibre trade. Special machinery for making textile and wicker fibre from reels of paper are now manufactured. The Scandinavian countries are producing large amounts of paper fibres, while the British government has for some time been interested and busy in the manufacture of paper fibre articles. The evenness of strength, freedom from odor, absence of loose ends, flexibility, elasticity, strength, as well as weather and water-proofing qualities make paper fibre to-day the most important strand in the manufacture of wicker-woven articles. In addition to the above advantages it is much cheaper and more abundant than any other form of wicker. The ability of paper to permit itself to be manufactured into wicker fibre, either alone or with cotton, wool and even wire centres, and its ability to accept modern chemical and other treatments for purposes of strength and elasticity, adds to its importance and growing popularity. All other forms of wicker are used in a more or less natural state and do not require or lend themselves to chemical or other advanced treatments of mankind. Wicker fibre, however, overcomes these objections. Since all other wickers except wicker fibre are used practically in their natural state it is necessary to weave the strands in large sizes. This does not make possible for them the beautiful finishes of the wicker-fibre articles. Owing to the smallness of the best hard wicker fibres, the article manufactured usually has from two to four times as many feet of fabric as the natural wicker woven articles, therefore making the wicker fibre article stronger. The shortness of natural wickers, like willow and reed, make it necessary for ends to occur frequently in furniture, baskets or baby carriage bodies. Wicker fibre can be made in endless strands, thus doing away with unsightly ends. Wicker fibre originates, like paper, from the forest with fir and pine proving the most satisfactory wood, although almost any kind can be used. After the trees have been cut and the logs sent to the paper mills a pulp is formed. (See PAPER). This pulp becomes paper and is cut into ribbons of various widths. These reels of paper ribbon are run through baths of casein glue for purposes of preservation and toughening. Then the ribbons enter twisting devices running 5,000 revolutions per minute. Sometimes wire centres are used but usually pure paper fibre is manufactured. The twisted paper ribbon is dried on large drums and then ready for weaving. After being woven the shaped article is dried and painted from two to four times with enamel or shellac. These various treatments make the fibre absolutely impervious to water, sunshine and other weather conditions.

MODERN WICKER BABY CARRIAGE.

It is woven of wicker fibre made on the Lloyd Loom. Note the fineness of the strand used in comparison to the flat reed of the other photograph.

Methods of Weaving.— Hand weaving must have been the only method used in biblical days, so far as wicker weaving is concerned, for there is no mention of any machine being used. The biblical method consisted of weaving two strands at right angles to each other, considerably or exactly like textile weaving (See TEXTILE INDUSTRY). When wicker was to be woven a frame was made and the upright strands or weft attached to it. Then the warp was interlaced through the weft. This method has been handed down through all

direction so as to hit the winner's stone and drive it from the tee, the former often replacing the latter and so becoming the winner in turn; also called "inringing."

WICKLOW, wik'lō, Ireland, a maritime county of Leinster Province, on the Irish Sea, with an area of 782 square miles. Chief town, Wicklow. The county generally is mountainous, but has fertile lowlands where oats and potatoes are cultivated, and much pasture land devoted to stock-raising. Iron and lead are mined, and a little copper. Pop. about 60,000.

WICLIF, wik'lif, **WICLIFFE, WICLEF, WICKLIFF,** or **WYCLIFF, John,** English reformer: b. Spreswell, Yorkshire, probably about 1330; d. Lutterworth, 31 Dec. 1384. He studied at Balliol College, Oxford, of which he became master between 1356 and 1361, in which later year he was appointed by his college to the living of Fillingham, in Lincolnshire. About the same time the Pope bestowed upon him a prebend in the collegiate church of Westbury-on-Trym, near Bristol, in which he was confirmed by the king. In 1368 he gave up Fillingham and accepted the living of Ludgershall, in Buckinghamshire, and four years later qualified as doctor of theology. He was presented by the Crown in 1374 to the benefice of Lutterworth, in the south of Leicestershire, which he held till his death. A Latin tract 'Determinatio quædam Magistri Johnannis Wyclyff de Dominio contra unum Monachum,' has been regarded as belonging to the controversy raised by the refusal of the Parliament of 1366 to pay a tribute demanded by the Pope Urban V, in virtue of the homage paid by King John to Innocent III, but some authorities refer it to a date about 10 years later, when similar circumstances arose. At the time of writing the tract, Wiclif was regarded as royal chaplain, for he calls himself *peculiaris regis clericus,* and in 1374 was named second on a commission which went to Bruges to try to settle disputes concerning ecclesiastical jurisdiction with the representatives of the Pope Gregory XI. He had shortly before been appointed a canon of Lincoln, but never actually obtained a prebend in that cathedral. The development of his views on the relation between the ecclesiastical hierarchy and the secular authorities brought him into close association with John of Gaunt, duke of Lancaster, and his party, and in 1377 the anti-Lancastrians sought to strike at their political opponents through Wiclif. He was summoned in that year before Archbishop Sudbury and his suffragans at Saint Paul's, and attended, accompanied by Lancaster, Lord Percy, and other powerful Lancastrians. A violent altercation between the duke and William Courtenay, bishop of London, caused the break-up of the meeting, and the infuriated populace plundered Gaunt's palace and attacked Percy's house. Soon afterward Pope Gregory sent several bulls to the University of Oxford, the archbishop of Canterbury, and the bishop of London, in which he accused Wiclif of teaching the condemned doctrines of Marsilius of Padua and John of Jandun, and ordered him to be arrested and examined. The parties were reluctant to move in view of Wiclif's great popularity and influence, and even after the bulls had arrived he was consulted by the government as to whether they might legally prevent money from going abroad to absentee holders of benefices. He eventually appeared before the prelates at Lambeth in 1378, but the king's mother sent a message forbidding them to interfere with him, and a popular demonstration in his favor put an end to the proceedings. In the Gloucester Parliament of 1378 he made a defense of John of Gaunt, who had grossly violated the Westminster right of sanctuary.

This year, 1378, was an important date in Wiclif's religious career. While continuing to inveigh against certain abuses, he began to question the whole basis of sacerdotalism and its authority, and by 1381 had attained to a substantially Lutheran position in regard to transsubstantiation and the mass. About this time also he commenced his appeal to the common people and presented religion as a popular force rather than a dogmatic system or an organized institution. This appeal assumed two forms, the sending out of his "poor preachers" and the translation of the Bible from the Vulgate into the English of his day. His itinerant evangelists spread his doctrines throughout the land and soon made the Lollard movement one of great strength and importance. In his translation of the Bible he had the assistance of Nicholas Hereford, who was responsible for most of the Old Testament, and the whole work was revised by his assistant, John Purvey, who finished it soon after Wiclif's death. Wiclif's views on the eucharist were promptly condemned at Oxford and forbidden to be taught there, and in 1382 Courtenay, archbishop of Canterbury, summoned a council in the Blackfriars' convent hall, at which Wiclif's teaching was condemned and some of his followers excommunicated. This council known as the "earthquake council" because a violent earthquake occurred during the meeting, ordered the Carmelite, Dr. Stokes, to publish the condemnation at Oxford. The chancellor of Oxford University at that time, Robert Rygge, was a supporter of Wiclif and evaded the duty of carrying out the council's mandate until absolutely compelled to do so. Wiclif himself remained untouched, but he retired to Lutterworth, where he occupied himself in preaching and writing. It is said that Urban VI summoned him to Rome in 1384, but this is doubtful. He had a paralytic stroke in 1382 or 1383, and again in 1384, from which he died. He was buried at Lutterworth, but in 1428, in accordance with a decree of the council of Constance in 1415, his body was exhumed and burned, and his ashes thrown into the river Swift.

Of the 24 Wiclifite propositions condemned by the earthquake council, 10 were described as heretical and 14 as erroneous. The most important of the 10 were: that transsubstantiation is philosophically false, since the substance cannot be changed while the accidents remain; that transsubstantiation is not taught in the Gospels; that confession is not necessary to salvation; that no one after Urban VI should be recognized as Pope; and that it is unscriptural for ecclesiastics to hold temporal possessions. Of the erroneous doctrines, several seriously limited the right of excommunication in a distinctly

Protestant sense, one asserted the right of unlicensed preaching, another declared that dominion, whether civil or ecclesiastical, could not belong to one in mortal sin, and another distinctly asserted the authority of the temporal power over the ecclesiastical in temporal affairs. Wiclif unmistakably made his appeal to Scripture as of higher authority than Church tradition or decrees, and had a strong sense of the individualistic basis of religion. He never reached the Lutheran doctrine of justification by faith, but from denunciation of abuses in the Church rapidly advanced to his three main positions: that all dominion was of divine origin and was forfeited by anyone in mortal sin; that transsubstantiation was a doctrine both unphilosophical and unscriptural; and that monasticism in every form was a corrupt institution.

At first he attacked only the luxurious and corrupt orders of monks and was on friendly terms with the friars, but from about 1379 the friars were also included in his condemnation. He was one of the last of the realists in philosophy, and he tried to reconcile predestination with the freedom of the human will. Not only was Wiclif one of the chief forerunners of the Reformation, but he was also a pioneer in English prose literature. He wrote many learned works in Latin, but the nature of his message and the necessities of his position led him to appeal to the people in works in their own tongue. His chief Latin works are 'De Dominio Divino'; 'De Dominio Civili'; 'De Officio Pastorali,' and 'Trialogus.' All, except the 'Trialogus' and the 'De Officio Pastorali,' and also volumes of Latin sermons and a volume of Polemical Works, have been edited by English and foreign scholars for the Wiclif Society. The excepted words were edited by Lechler (1869 and 1863 respectively). His translation of the Bible was edited by Forshall and Madden (1850); and his English works are to be found in the three collections 'Three Treatises of John Wycliffe' (1851), by Todd; 'Select English Works of Wyclif' (1869–71), by T. Arnold; and 'The English Works of Wyclif' hitherto unprinted (1880, Early English Text Society), by F. D. Matthew.

Bibliography.— 'Wiclif' in the Dictionary of National Biography; Lechler, 'Johann von Wiclif und die Vorgeschichte der Reformation' (1873); Poole, 'Wycliffe and Movements for Reform' (1889), and 'History of Mediæval Thought' (1884); Burrows, 'Wyclif's Place in History' (1881); Buddensieg, 'Johann Wiclif und seine Zeit' (1885); Stevenson, Jos., 'The Truth About John Wiclif'; Parson, 'Studies in Church History' (Vol. 2); Gasquet, F. A., 'The Eve of the Reformation'; and Cadman's article on Wycliffe' in 'Three Religious Leaders of Oxford' (New York 1916).

WIDDIN, vid'in, or **VIDIN,** Bulgaria, a town on the right bank of the Danube, near the Serbian frontier, consisting of three parts, the town on the Danube, the walled city and the citadel. The principal buildings are the palace, several mosques with lofty minarets and a range of bazaars lining the main street. Ships can reach the town at high-water. There is a considerable trade, chiefly in corn, wine and salt, and the chief manufactures are gold and silver filigree work and jewelry. Widdin was formerly strongly fortified and during Russo-Turkish wars was important strategically, but the Treaty of Berlin (1878), which erected Bulgaria into a hereditary principality tributary to the Porte, decreed that its fortifications should be dismantled. Pop. about 15,000.

WIDE AWAKES, in American political history, a name adopted by numerous Republican campaign clubs organized for the purpose of aiding in the election of Abraham Lincoln during the Presidential campaign of 1860. The first club was organized in Hartford, Conn. It is stated that in New York City there were on one occasion 20,000 Wide Awakes marching in procession.

WIDE, WIDE WORLD, The, a tale by Susan Warner, published in 1851 under the pen name of "Elizabeth Wetherell." It reached a sale of over 300,000 copies. The life of the heroine, Ellen Montgomery, is followed from early childhood to her marriage with a fullness of particulars which leaves nothing to the reader's imagination. The scenes and episodes are those of a homely, every-day existence, described with close fidelity to detail. Ellen's spiritual experience is minutely unfolded, and the book was long regarded as one of those which are "good for the young." The criticism of a later generation pronounces it mawkish in sentiment and unreal in conduct. It stands among the fading fancies of an earlier and less exacting literary taste.

WIDENER, Peter A. Brown, American capitalist: b. Philadelphia, Pa., 13 Nov. 1834; d 6 Nov. 1915. He acquired a large fortune in the meat business, entered politics, was appointed city treasurer of Philadelphia in 1873 and in 1874 was re-elected to that office. He became largely interested in street railway corporations, and was associated with both the tobacco and Standard oil groups of capitalists. In 1897 he presented to the city of Philadelphia his private residence, valued at $600,000, for a branch of the Free Lending Library, and in the following year gave to the library a collection of 500 rare books valued at $28,000. In 1899 he endowed at Philadelphia the Widener Memorial Training School for Crippled Children, a combined home, hospital and school. The school site consists of a tract of 36 acres at Logan, a Philadelphia suburb.

WIDGEON, or **WIGEON,** a river-duck of the genus *Mareca*. Widgeons have a short bill, rounded at the tip, with a strong, broad nail, and the upper lamellæ prominent; wings long and pointed; tail, moderate and wedge-shaped. There are about 10 species in various parts of the world. They are found on the seashore and on the margins of lakes and rivers, feeding chiefly on vegetable substances, and performing periodical migrations at night in vast flocks. The American widgeon or baldpate (*M. americana*) is about 18 inches long; the bill is blue, black at the base and tip; upper parts finely waved transversely with dark lines; lower parts mostly white; top of head nearly white, with a broad green patch around and behind the eyes; the rest of the head and neck grayish, spotted and banded with black; the wing-covers are white, the greater part tipped

with black; the speculum is green, encircled by black. The baldpate is found throughout North America, breeding chiefly north of the United States and wintering in Central America. It is an active bird, with a swift and well sustained flight, in ranks of various and irregular forms, and it associates during the winter with teals and other ducks. The flesh is highly esteemed, especially when they have fed in the rice fields of the South, or along with the canvas-back on the water-celery of the Chesapeake. They do not dive, but feed with the head and neck immersed, swimming very near together. Their food consists of aquatic seeds, roots, insects, worms, small fry, leeches, nuts and grain, especially rice in the rainy season; being very fond of the tender aquatic plants on which the canvas-back feeds, and no diver itself, it watches the latter and snatches the morsels as it emerges and before it has had time to open its eyes. They are among the most difficult ducks to shoot, owing to their shyness and swift, irregular flight. The nest is built on the ground, often far from water and usually of leaves lined with down. The eggs number eight or 10, are pure ivory white and about two inches long by nearly one and one-half in diameter. The European widgeon (*M. penelope*) is rather smaller, and not uncommon all along the Atlantic Coast of the United States, as well as on the Pacific. It differs chiefly in having the head and neck reddish brown or cinnamon, the top of the head cream-colored. Consult Grinnell, 'American Duck Shooting' (New York 1902).

WIDNES, England, a manufacturing town in Lancashire, on the Mersey, opposite Runcorn, 13 miles east-southeast of Liverpool. There are extensive chemical, alkali and soda works; soap, candle, grease and manure works; copper-smelting works and rolling-mills, and iron-foundries. The town has a considerable carrying trade, which has been further developed by the construction of large docks in 1866, extended in 1884. Pop. 30,000.

WIDNMANN, vĭd'n-mān, **Max,** German sculptor: b. Eichstätt, Bavaria, 13 Oct. 1812; d. Munich, Bavaria, 3 March 1895. He was educated at Munich and at Rome, executing while at the latter city his "Shield of Hercules," considered one of his masterpieces, and in 1849 became professor of sculpture at the Academy of Art at Munich. Several of the public monuments in that city are by him, but his best work is considered to be shown in his busts and statuettes, which, however, are fewer in number. His statues include those of Orlando de Lasso (1848); Schiller (1863); Goethe (1868); Castor and Pollux (1877). Specimens of his workmanship are to be found at Bamberg, Ratisbon, Wurzburg and other cities.

WIDOW, one who has lost her husband by death and remains unmarried. A "grass-widow" is a divorced woman. Among the ancients was practised a form of funeral sacrifice, in which the widow was slain or induced to commit suicide so that she might be buried with her husband and accompany him to the world of spirits. This practice is mentioned as existing among the Greeks by Euripides and Pausanias, and from Cæsar it may be inferred that it existed also in Gaul. Widow sacrifice is still the custom in some African tribes; traces of it may be found in China; it lingered till late in the first half of the 19th century in Fiji, and though abolished by law in British India in 1829, was not wholly stamped out until late in the 19th century.

WIDOW BEDOTT (bĕ-dŏt') **PAPERS, The,** a collection of broadly humorous sketches by Frances Miriam Whitcher, which appeared first in Neal's *Saturday Gazette* of Philadelphia, about 1847, and in book form in 1855. They were extremely popular in their day and are still read and quoted from, though they have been followed by many works in a similar vein.

WIDOW-BIRD. See WHYDAH-BIRD.

WIELAND, vē'lānt, **Christoph Martin,** German author: b. in the Swabian village of Oberholzheim, near Biberach, 5 Sept. 1733; d. Weimar, 20 Jan. 1813. The son of a country clergyman, after thorough preparation, he went in 1750 to the University of Tübingen to study law, but most of his time was devoted to *belles-lettres.* In 1751 appeared his 'Zwolf Moralische Briefe,' which met with very favorable reception. He also wrote at this time the didactic poem, 'Anti Ovid.' In 1752 he went to Zurich as a literary companion to J. J. Bodmer (q.v.). Inspired by the deeds of Frederick the Great to write a poem exhibiting the ideal of a hero, he chose the story of Cyrus. The first five cantos appeared in 1759, but the poem remained unfinished. About this time he published 'Araspes and Panthea,' an episode from the 'Cyropædia' of Xenophon. After a brief residence he left Bodmer's house, became a tutor, and in 1760 returned to Biberach. In 1762 he went to live with Count Stadion, an accomplished scholar, but a thorough man of the world, averse to all religious enthusiasm. Wieland had been prone to religious mysticism; but the gay pleasure-seeking life of the society with which he now came in contact, and the sceptical and cynical kind of literature now most at his command, produced an entire change of sentiment. The first indication of this new philosophy of life appears in the tale of 'Nadine,' which he styles a composition in Prior's manner. This was followed in 1764 by 'Die Abenteuer des Don Sylvio de Rosalva' ('The Adventures of Don Sylvio de Rosalva'), a work for which Don Quixote serves as model. In 1766–67 appeared his 'Agathon,' which established his reputation. The 'Musarion' (1768), a production distinguished for grace, ease and harmony, advocates a rational unity of the sensual and spiritual. In 1770 he wrote 'Die Grazien' ('The Graces'); and the 'New Amadis' in 1771, a poem which celebrates the triumph of intellectual over mere physical beauty. In 1769 he was appointed *professor primarius* of philosophy at the University of Erfurt. In his 'Verklagter Amor' ('Cupid Accused') he defended amatory poetry; and in the 'Dialogen des Diogenes von Sinope' (1770) gave a general vindication of his philosophical views. In 1772 he was invited to Weimar by the Duchess Anna Amalia as tutor to her two sons. Turning his attention to dramatic poetry, he wrote the 'Wahl des Hercules' ('Choice of Hercules'), and the 'Al-

ladies from those of Egypt. Under the Roman emperors it became common even for men to wear wigs, and several of the emperors themselves used this ornament. In the latter half of the 16th century the fashion became much in vogue in France, Italy and England. In 1560 no lady appeared at the French court without a blonde wig. Louis XIII set the fashion, wearing a wig of long curls, being himself bald. The courtiers naturally followed. Louis XIV was at first averse to wigs; but in the latter part of his reign, when he began to lose his own hair, he reintroduced the fashion, which went to a greater extreme than ever. About 1660 they began to be worn by the clergy, who had at first shown themselves hostile to the practice. The practice of powdering these wigs was adopted about the year 1700. About 1720 the great wig began to give place to the queue, which remained the fashion till early in the 19th century. Modern refinement has abolished the wig as an ornament except in Great Britain for the lord-chancellor, judges and barristers. They are still worn by actors and actresses as a part of the make-up or dress suitable to a particular character.

WIGAN, England, a town of Lancashire, on the Douglas, 21 miles northeast of Liverpool. Wigan stands in the centre of an extensive coal field, and its manufactures, which are important, consist chiefly of calicoes, fustians and other cotton goods, linens, checks, cotton twist, etc., besides iron foundries, iron forges, railway car works, iron rolling mills, large breweries, chemical works and corn and paper mills. It has a Mining and Technical College. Pop. 90,000.

WIGGIN, wig'in, **Kate Douglas Smith,** American author: b. Philadelphia, Pa., 28 Sept. 1859. She was educated at Abbott Academy, Andover, Mass., and in 1876 went to California, where she studied the kindergarten system in Los Angeles, and later at San Francisco organized the first free kindergarten in the West. In 1880 she was married to S. B. Wiggin, a lawyer (d. 1889), and removed to New York. In 1895 Mrs. Wiggin was married to George C. Riggs. In 1906 Bowdoin College gave her the Litt.D. degree. She published, with her sister, Nora A. Smith, 'Froebel's Gifts' (1895); 'Kindergarten Principles and Practice' (1896), etc. Her other works, several of which have attained great favor in this country and England, include 'The Bird's Christmas Carol' (1888); 'The Story of Patsy' (1889); 'A Cathedral Courtship' (1893); 'Mann Lisa' (1896); 'Penelope's Progress' (1898); 'Penelope's Experience in Ireland' (1901); 'Diary of a Goose-girl' (1902); 'Rebecca of Sunnybrook Farm' (1903); 'New Chronicles of Rebecca' (1907); 'Susanna and Sue' (1909); 'Mother Carey's Chickens' (1911; dramatized 1915), etc.

WIGGINS, Benjamin Lawton, educator: b. Sand Ridge, S. C., 11 Sept. 1861; d. Sewanee, Tenn., 1909. His education was received at the University of the South from which he was graduated in 1880. He afterward (1883-84) pursued graduate work at Johns Hopkins University. In 1882 he returned to the University of the South as professor of Greek, which position he held until his death, with the added duties (after 1893) of vice-chancellor or president. Under his supervision the University of the South became one of the leading institutions in the Southern States.

WIGGINS, (John) Carleton, American artist: b. Turners, N. Y., 4 March 1848. He studied at the National Academy of Design in New York and under George Inness and H. Carmiencke and later in Paris. He first exhibited at the National Academy in 1870, and at the Paris Salon in 1881. He painted landscapes, and was especially successful in his paintings of cows. He was elected to the National Academy in 1906. His works are well represented in both public and private collections. Among them are 'A Holstein Bull' (Metropolitan Museum of Art, New York); 'Morning on the Hills' (Brooklyn Museum); 'October' (Corcoran Art Gallery, Washington); 'Lake and Mountains' (Chicago Art Institute); 'Evening after a Shower' (National Gallery, Washington); 'The Wanderers' (Hamilton Club, Brooklyn); 'Ploughing in France'; 'Plough Horse' (Lotus Club, New York); 'After Wind—Rain,' etc.

WIGGINS, Guy Carleton, American artist, son of (J.) C. Wiggins (q.v.): b. Brooklyn, N. Y., 23 Feb. 1883. He studied under his father and at the Polytechnic Institute, Brooklyn, and the National Academy of Design, New York. He is notably successful in his portrayal of scenes in New York, and is also known for his landscapes. Among his works are 'Metropolitan Tower' (Metropolitan Museum, New York); 'Columbus Circle, Winter' (National Gallery, Washington); 'Berkshire Hills, June' (Brooklyn Museum), etc. He was made associate of the National Academy in 1916.

WIGGINS, Joseph, English sea captain and explorer: b. Norwich, 3 Sept. 1832; d. Harrogate, 13 Sept. 1905. He was apprenticed to his uncle, a shipowner, at the age of 14 and at 21 rose to be master of a ship. He afterward became owner of several cargo vessels and developed a keen interest in the project of developing a trade route between the countries of northern Europe and Siberia by means of the Northeast Passage through the Arctic seas. His first voyages, in 1874, 1875, 1876 and 1886-87 were less successful for the actual cargo delivery than for their awakening of interest in the matter and for his brilliant achievements as a navigator, demonstrating the possibility of taking ships far beyond any point hitherto reached. In 1887 he sailed up the Yenisei River to Yeniseisk. His first notable achievement in the delivery of a cargo was that of a shipment of rails for the Trans-Siberian Railway, in 1893, for which feat he was honored by the tsar. He made another successful visit to Yeniseisk in 1895. He was selected to take charge of a relief expedition into Siberia at the time of the famine in 1903 but died while preparations were under way. He received in 1894 the Murchison Medal of the Royal Geographical Society. Consult Johnson, H., 'Life and Voyages of Joseph Wiggins' (London 1907).

WIGGLESWORTH, wig'lz-werth, **Michael,** American Puritan clergyman: b. Yorkshire, England, 1631; d. Malden, Mass., 10 June

1705. In 1638 he was brought to Charlestown, Mass., by his father and accompanied him in the same year to New Haven, Conn. He was graduated from Harvard in 1651, subsequently becoming a tutor there. He then studied theology and was settled as pastor of the Church of Malden in 1656. He was accounted skilful in medicine, and was offered the presidency of Harvard in 1684, but on account of ill health declined the honor. His best-known work, 'The Day of Doom' (1662), was a popular poem in New England for a long period. Two editions were printed in England and the sixth edition in New England appeared in 1715. The savage Calvinism of the poem is unsurpassed in literature save perhaps in Jonathan Edwards' sermon, 'Sinners in the Hands of an Angry God,' but the work contains not a little dramatic force and here and there passages of dignity and beauty. He also wrote 'God's Controversy with New England' and 'Meat out of the Eater,' in verse; and 'A Discourse on Eternity.' Consult Tyler's 'History of American Literature' (1878); and Dean, 'Memoir of Michael Wigglesworth' (1863; new ed., 1871).

WIGHT, wit, Orlando Williams, American physician and translator: b. Centreville, N. Y., 19 Feb. 1824; d. Detroit, Mich., 19 Oct. 1888. He was educated at the Rochester Collegiate Institute, removed to New York in 1847, studied theology and was ordained to the Universalist ministry. He subsequently studied medicine, being graduated from the Long Island College Hospital in 1865. He engaged as a medical practitioner in Wisconsin, and was appointed State geologist and surgeon-general in 1874. He was health commissioner of Milwaukee in 1878–80, and health officer of Detroit in 1882–88. He was a noted translator and throughout his life devoted a large share of his time to literary work. He wrote 'Maxims of Public Health' (1884); 'Peoples and Countries Visited' (1888), etc. His translations include 'History of Modern Philosophy,' with F. W. Ricord (1852); 'Lives and Letters of Abélard and Héloïse' (new ed., 1861); Martin's 'History of France,' with Mary L. Booth (1863), etc. He also edited 'Standard French Classics' (14 vols., 1858–60); 'The Household Library' (18 vols., 1859, et seq.), etc.

WIGHT, Peter Bonnett, American architect: b. New York, 1 Aug. 1838. He was graduated from the College of the City of New York in 1855, practised as an architect in New York in 1861–71, and since 1871 in Chicago. He has been secretary of the Illinois State board of architects since 1897, was elected to the American Institute of Architects in 1866, and from 1900 to 1905 was secretary of the Municipal Art League of Chicago.

WIGHT, Isle of, England, off the south coast, in the county and opposite to the mainland portion of Hants, is separated from the mainland by the roadstead or channel of Spithead on the east, and by the Solent or continuation of this on the west. It is about 23 miles in length from east to west, by 15 miles broad; circuit about 70 miles; area, 146 square miles. The land is rolling, affording agreeable scenery; the air is remarkably healthful. Only a small portion of the surface is waste. The downs, which cross the island from east to west and form excellent sheep-walks, separate it into two districts, which in their general character contrast with each other, the soil on the north side being generally a stiff, cold clay, and on the south side a fertile sandy loam. On the promontory that forms the western extremity of the island are three notable chalk cliffs locally called the 'Needles.' Celtic tumuli occur on a number of the chalk downs, and there are monoliths of geologic interest. Excellent cement is manufactured at the works on the west side of the Medina, and largely exported. The chief imports are cattle, coal, timber and building material. The island is well defended, being protected on the east side by Sandown Fort, Bembridge Fort and Battery, and by other forts which lie between the island and the mainland. The western approach is guarded by Hurst Castle and other forts. The chief towns are Newport (the capital), Ryde, Cowes, Ventnor, Brading, Yarmouth and the fashionable health resorts of Sandown and Shanklin on the southeast coast. Osborne, near Cowes, was a residence of Queen Victoria, and with its beautiful grounds is now a national memorial, the gift of Edward VII. Its most recent use is as a college for naval cadets. Among the antiquities of the Isle of Wight the most interesting is Carisbrooke Castle, which stands a little southwest of Newport, and consists of extensive and well-preserved picturesque ruins. It has many historical associations: it is supposed to have originally been a fortress of the Britons, was afterward repaired and enlarged by the Romans, was considerably strengthened under Cerdic, who founded the kingdom of Wessex, and rebuilt in the reign of Henry I. During the Parliamentary War it became the asylum of King Charles I on his escape from Hampton Court, and afterward his prison. Another interesting remain is Quarr Abbey, about two and one-half miles from Ryde, which was built in 1132, and is now a farmhouse. Pop. 90,000. Consult Thomas's 'Isle of Wight' (Boston 1912).

WIGMORE, John Henry, American lawyer and university dean: b. San Francisco, 4 March 1863. He studied law at Harvard and practised at Boston from 1887–89. For three years following, he was professor of Anglo-American law at Keio University, Tokyo, Japan. He has since been connected with Northwestern University, first in the capacity of professor of law, and subsequently, since 1901, as dean of the faculty of law. His published works include 'Digest of the Decisions of the Massachusetts Railroad Commission' (1888); 'The Australian Ballot System' (1889); 'Notes on Land Tenure and Local Institutions in Old Japan' (1890); 'Materials for the Study of Private Law in Old Japan' (1892); 'Treatise on Evidence' (4 vols., 1904–05); 'Pocket Code of Evidence' (1909); 'Principles of Judicial Proof' (1913). He is also editor of 'Greenleaf on Evidence' (16th ed. 1899); 'Compiled Examinations in Law' (1900); 'Cases on Torts' (2 vols. 1911); 'Cases on Evidence' (1913), and coeditor of 'Select Essays in Anglo-American Legal History' (1907); 'Evolution of Law Series' (1915). Mr Wigmore was president of the American Institute of Criminal Law and Criminology' (1909–10), and in 1916 received the

commission of major on the staff of the Judge-Advocate-General of the United States, being promoted commanding lieutenant-colonel in 1918. In February 1917 he was appointed a member of the United States High Commission.

WIGTOWN, or **WIGTON,** county forming the southwest corner of Scotland; bounded west by the North Channel, north by Ayrshire, east by the Stewartry of Kirkcudbright and the Solway Firth, and south by the Irish Sea. The extent from east to west is about 33 miles, from north to south about 26 miles; area, 485½ square miles, of which about 46 per cent is arable. This county which constitutes West Galloway was formed about 1341. It lies between lat. 54° 38′ and 55° 4′ N., and long. 4° 16′ and 5° 6′ W. Wigtown is somewhat irregular in form, being deeply intersected by two arms of the sea, one of which, Loch Ryan, a long narrow inlet, stretches south from the northwest corner for nine miles into the county, while Luce Bay on the south makes a wide indentation 18 miles long with an average width of 12 miles, the heads of the inlet and bay being only six miles apart. The western part of Wigtown, known as the "Rhins of Galloway," thus forms a peninsula whose length north to south is 28 miles, and breadth one and one-half to six miles; its northern extremity is Corsewall Point, and its southern the Mull of Galloway, each promontory being provided with a lighthouse. The southeastern half of Wigtown is separated from the Stewartry of Kirkcudbright by Wigtown Bay, 15 miles long and 14 wide at its mouth, and between this bay and Luce Bay Wigtown extends south in a blunt triangular form, terminating in Burrow Head. Wigtown is irregular in surface, but with no eminences exceeding 500 feet. The soil is varied, and except a portion along the sea-shore, especially in the southeastern part which consists of a rich loam — the quality is inferior. The climate is mild but moist, the rainfall being comparatively great. There are many dairy establishments. Wigtown contains three rivers of considerable size, the Cree, the Bladnoch and the Luce — the Cree and Bladnoch being navigable for a few miles. Small fresh-water lochs are numerous. There were at an early period many religious houses in the country and the church, believed to be the oldest in Scotland, founded by Saint Ninian, was built near the site the present village of Whithorn. The principal towns are Wigtown, Newton-Stewart, Stranraer and Whithorn. There is no mineral wealth and little trade or manufacture. Pop. 32,685.

WIGWAGGING, a system of visual signaling by means of hand flags and for short distances only. The color of the flags depends on the background. The flags used in the United States army are 18 inches square with a nine-inch centre, while those of the navy are from 12 to 15 inches square. The staffs are light and average about 24 inches in length. See SIGNALS and SIGNALING.

WIGWAM, among the American Indians a lodge, cabin, hut or tent, generally of a conical shape, formed of bark or mats laid over stakes planted in the ground, and converging toward the top, where there is an opening for the escape of the smoke. The most common form is the teepee, which is portable, being usually a framework of roughly trimmed poles, lashed together with split wood, thongs, etc., and covered with hides, bark, matting, etc. Those designed to be more permanent, approached the log-house or bark shack in construction, and often surrounded an earth or rock fireplace, whose smoke was carried off through a central hole at the top. The word has also been applied to a large temporary structure for public gatherings.

WILARS DE HONECOURT, vē-lär dē hōn-koor, French architect of the 13th century. He is one of the earliest recorded experimenters with the perpetual motion theory, his rude drawings of his plans being still preserved in his sketch book at the Ecole des Chartes at Paris.

WILBER, wil'bėr, Neb., village, county-seat of Saline County, on the Big Blue River and on Chicago, Burlington and Quincy Railroad, 30 miles southwest of Lincoln. It is in a rich agricultural region, in which the chief products are wheat and corn. It has flour mills, grain elevators, machine shop, creameries and cigar factories. There are six churches, a high school, two newspapers and a county courthouse. The two banks have a combined capital of $100,000.

WILBERFORCE, wil'bėr-fôrs, **Robert Isaac,** English clergyman, 2d son of William Wilberforce (q.v.): b. Clapham, Surrey, 19 Dec. 1802; d. Albano, Italy, 4 Feb. 1857. He was graduated from Oriel College, Oxford, in 1823, and was subsequently chosen Fellow of his college, associating in that capacity with Pusey and Newman, Hurrell Froude and other leaders of the High Church party. In 1830 he left Oxford to take charge of a parish, and became vicar in 1840 of Burton Agnes, Yorkshire. He published 'Church Courts and Discipline' (1843); 'Lucius, or Stories of the Third Age' (1842); 'Doctrine of the Incarnation' (1848); and 'Doctrine of Holy Baptism' (1849), the two last attracting great attention by the very positive doctrines they enunciated. He also published a 'History of Erastianism' (1851); 'Doctrine of the Eucharist' (1852); 'Inquiry into the Principles of Church Authority' (1854), etc. Finding that he could no longer consistently hold his position in the Church of England, he was received into the Roman Catholic Church in Paris in October 1854.

WILBERFORCE, Samuel, English prelate, 3d son of William Wilberforce (q.v.): b. Clapham, Surrey, 7 Sept. 1805; d. near Dorking, Surrey, 19 July 1873. He was graduated from Oriel College, Oxford, in 1826, ordained deacon in 1828, and appointed curate of Checkendon, Oxfordshire, the same year. He was rector of Brightstone, in the Isle of Wight, 1830–40, in 1839 became archdeacon of Surrey, and in 1840 a canon of Westminster. In the last-named year also he became rector of Alverstoke, Hampshire. He received the deanery of Westminster in March 1845, but before the close of that year was promoted to the bishopric of Winchester. He was the leader of the High Church party, though much opposed to ritualism, and was both witty and eloquent as well as a skilful debater in the House of Lords. His readiness in argument and his versatile qualities gained him the title of "Soapy Sam." He pub-

churches, and about 4,000 communicants. See FRIENDS, THE RELIGIOUS SOCIETY OF.

WILCOX, wil'köks, **Cadmus Marcellus,** American soldier: b. Wayne County, N. C., 19 May 1826; d. Washington, D. C., 2 Dec. 1890. He was graduated from West Point in 1846, served in the Mexican War, and in 1860 was promoted captain. In 1861 he resigned from the army and entered the service of the Confederacy. He participated in the first battle of Bull Run, was promoted brigadier-general in October, and in 1863 became major-general. He was engaged in the second battle of Bull Run, at Fredericksburg, Chancellorsville, Salem Heights, Gettysburg and other important battles, and was present at the surrender at Appomattox courthouse. He was offered a commission as brigadier-general in the Egyptian army after the close of the Civil War, but declined it. In 1886–89 he was chief of the division of railroads at the general landoffice in Washington. He wrote 'Rifles and Rifle Practice' (1859); translation 'Austrian Infantry Evolutions of the Line' (1860); and an excellent 'History of the Mexican War,' the manuscript of which was completed and published by his niece, M. R. Wilcox (1892).

WILCOX, Delos Franklin, American municipal government expert: b. Ida, Mich., 22 April 1873. He was graduated at the University of Michigan in 1894 and took the degree of Ph.D at Columbia University in 1896. He edited the Detroit *Civic News* in 1905–07; and in 1907–13 he was chief of the bureau of franchises in the first district of the New York Civil Service Commission; while in 1914–17 he was deputy commissioner of the New York department of water supply, gas and electricity. He is a recognized authority on municipal government and has written extensively on the subject. His works include 'The Study of City Government' (1897); 'Ethical Marriage' (1900); 'The American City' (1904); 'The Government of Great American Cities' (1908); 'Municipal Franchises' (2 vols., 1910–11); 'Great Cities in America' (1910); 'Government by all the People' (1912), etc.

WILCOX, Ella Wheeler, American poet: b. Johnstown Centre, Wis., 1855; d. South Beach, Conn., 30 Oct. 1919. She was educated at the University of Wisconsin and in 1884 began her literary career by contributing to the periodical press, and her work has been widely read and extensively reprinted. 'Poems of Passion' (1883) gave her a national reputation. Her verse has been widely published in daily newspapers. In recent years she dealt more and more with subjects pertaining to the higher life, the brotherhood of man, faith in a future life, reincarnation, etc. Among her other publications, in verse, are 'Drops of Water' (1872); 'Maurine and Other Poems' (1876); 'Poems of Pleasure' (1887); 'The Beautiful Land of Nod' (1892), etc. She also wrote the novels, 'Mal Moulée' (1885); 'A Double Life' (1890); 'An Erring Woman's Love' (1892); 'The Story of a Literary Career' (1904); 'Poems of Sentiment' (1906); 'Poems of Progress and New Thought Pastels' (1910); 'Sailing Sunny Seas' (1911); 'Historical Mother Goose' (1914); 'Poems of Problems' (1914); 'The World and I' (1919).

WILCOX, Marrion, American author: b. Augusta, Ga., 3 April 1858. He was graduated from Yale in 1878, made special studies at the universities of Oxford, Heidelberg, Jena and Berlin, and was subsequently admitted to the New York bar. He acted as instructor at Yale in 1884–86, was associate editor of the *New Englander* and the *Yale Review*, and since 1893 has been engaged in editorial and other literary work in New York. In 1902 he became noted as an advocate of fair play to Cuba, defending the principle of reciprocity in the United States and urging concessions from the political leaders and economic associations of Cuba. His principles were approximately those embodied in the treaty submitted to Congress and accepted in 1903. In 1906–07 he visited South America and Mexico. In 1907 and especially in Mexico, Brazil and Argentina Mr. Wilcox suggested the interchange of professors between the United States and Latin-American countries. He has published 'Real People' (1886); 'A Short History of the War with Spain' (1898); 'Harper's History of the War in the Philippines' (1900); 'Sketches in Spain, England and Italy,' etc. He contributed many articles on Central and South American topics to the 'Encyclopedia Americana' and edited, in collaboration with George E. Rines, 'The Encyclopedia of Latin-America' (1917). Mr. Wilcox is a contributor to the *North American Review*, the *Churchman*, *Atlantic Monthly*, the *Scientific American*, the *Architectural Record*, and other periodicals.

WILCOX, Robert William, American legislator: b. Kuhulu, Honolulu, Hawaii, 15 Feb. 1855; d. Honolulu, Hawaii, 24 Oct. 1903. He was educated in Hawaii and at the Royal Military Academy, Turin, Italy. He was a member of the native legislature, led the revolution to restore the old constitution in 1889, and in 1895 again commanded a revolution, on this occasion for the purpose of restoring Queen Liliuokalani to the throne. He was captured and sentenced to death, but through the mediation of the United States Congress the sentence was commuted to 35 years' imprisonment and $10,000 fine. He was pardoned, conditionally in 1896, and fully in 1898, by Governor Dole. He was elected a delegate to the United States Congress in 1901 and served one term.

WILD, Heinrich, hin'rih vilt, Swiss meteorologist: b. Uster, 17 Dec. 1833; d. Zürich, 5 Sept. 1902. His education was obtained at Zurich, Königsberg and Heidelberg, and from 1863 to 1865 he was director of the central meteorological bureau at Bern. He was called to Saint Petersburg, and was director of the Russian meteorological service 1868–95, when he retired. He invented the polaristrobometer, a polarization plutometer, a magnetic theodolite and other optical instruments, edited the Russian 'Neues Repertorium für Meteorologie,' and published 'Temperatur-Verhältnisse des russischfen Reichs' (1876), and technical papers.

WILD, Jonathan, English thief and informer: b. Wolverhampton, England, about 1682; d. London, 24 May 1725. He was a Birmingham buckle-maker who in 1706 went to London intending to engage in his trade, but becoming involved in debt was imprisoned for

the consequent limitations; but the sketches of Irish life are curious and picturesque.

WILD LIFE, Conservation of, in America. Nothing in the New World impressed the first American explorers more than the abundance of its animal life. Early accounts of the country and its resources are filled with rejoicing over the plenitude of its fishes in both the sea and the inland waters; and of the edible or otherwise useful creatures of forest and plain, especially fur-bearers. During the first century of colonization the fisheries and the fur-trade engaged a large part of the population, and all were utterly unrestrained in their drafts on what seemed to them an inexhaustible wealth. This reckless destruction of American animal life, for the sake mainly of pelts or hides, continued as civilization penetrated to the interior until finally not only beasts of prey but the valuable beaver and marten, the wapiti and other deer, and the bison, antelope and bighorn sheep were all but exterminated, various game-birds and waterfowl were depleted and many of the most important fishes, especially those of anadromous species, like the salmon and shad, were nearly destroyed. The wild pigeon is only a conspicuous example of a dozen or more species of useful or beautiful birds that have become totally extinct, and many more have been saved only at the last moment by the strenuous efforts of men who fought the ignorance and greed of lawless gunners and fishermen, often at the peril of their lives. The loss to this country and to Canada (included in this survey) has been incalculable. It is true that a large part of it was inevitable, for it is impossible to civilize a region and maintain the whole of its animal life, much of which could not survive the changed conditions apart from any enmity of man; but the needless waste has been prodigious and sinful. Nevertheless, it is only within a comparatively recent time that even the wisest men of America have awakened to the importance of preserving what remains of the continent's wild life.

Regulative efforts began to be made in the 18th century in the older Eastern States by local laws forbidding shooting in the breeding season, the taking of fish on their spawning-grounds, or on their way thereto, and conserving certain fur-bearers, but these regulations were local and related almost wholly to animals of market value. Gradually these enactments were copied in newer western and southern communities, and were broadened in scope, yet had only a limited effect, partly because they were far from uniform even in adjoining States and were weakened by many exceptions, but mainly because they were not, and perhaps could not, be well enforced, for the people generally were not interested or even felt an inherited prejudice against "game laws" of any sort.

The first popular alarm was felt when, in the middle of the last century, the governments of both the United States and Canada discovered that the decline in the fisheries had reached a danger-point. This led to the making of more stringent laws and their better enforcement, particularly on the Great Lakes. Accompanying this revival of effort scientific studies of food fishes were promoted by the governments, which resulted in learning how to propagate fishes artificially on a commercial scale, and thus restock depleted waters. With this movement, by which alone the fisheries of the Great Lakes and other inland waters have been maintained, the name of Spencer F. Baird (q.v.) is permanently associated. These methods, protected by stringent laws and policing, have kept a supply of shad, salmon and other anadromous fishes in our rivers; and sensible regulations are preserving the great sea-fisheries for cod, herring, mackerel and many southern species. Similarly the small lake and river fishes of local food value, or interesting to anglers, are now fairly well protected and replenished under the watchful care of State commissions and various anglers' associations. Regulative care is preserving well also the oyster, clam, crab and other shellfish supply.

Public sentiment and legal control had been steadily improving and were stimulated by the sudden perception, about 1875, that the bison, the wild pigeon, the prairie chicken and other well-known animals would soon become extinct unless rescued. At this time, too, sprang up the world-wide fashion of using stuffed birds, and their wings and feathers, in millinery. Ruthless slaughter of egrets, hummingbirds and every sort of song-bird as well as larger kinds began; and in 1885 the Audubon Society was organized to try to stem the tide of destruction and bring to the minds of women a knowledge of the economic as well as moral wrong involved in the fashion that was sacrificing bird-life all over the world. Out of this movement grew the National Association of Audubon Societies (q.v.), which has been the most powerful factor in bringing *all* the birds of the country under the protection of good laws. Finally, it was largely instrumental, in co-operation with the United States Biological Survey and several sportsmen's organizations, in arranging a treaty with Canada covering the safety of migratory birds equally in both countries. This treaty, the way for which was paved by the United States Federal law of 1913, protecting all migratory birds, regardless of State lines, was finally ratified in 1916 — abolishing in this respect international lines — by the Congress of the United States and by the Parliament of the Dominion of Canada, both of which bodies arranged for its enforcement. The conservation of American bird-life may now be said, therefore, to be in a satisfactory condition.

Meanwhile, under the sympathetic encouragement of President Roosevelt, continued by his successors, certain areas have been set apart from the public domain — in most cases tracts virtually useless for agriculture or grazing — as "Reservations" wherein the destruction of all living and harmless creatures is prohibited. This policy began with the seclusion of the animals of the Yellowstone, Glacier, Mount Olympus and other national parks. But these mountainous and forested places were not suited to the larger plains-animals, for which special reservations were soon prepared. This policy began with the Wichita National Game Preserve in southeastern Oklahoma, covering 57,120 acres. It contains a fenced bison-range of 9,760 acres, which in 1908 was stocked with a band of bisons by the New York Zoological Society; this band has since increased to nearly

100, and many antelopes and deer have been set free in similar great enclosures. Another bison-range was established in northern Montana and stocked in 1910 by the Bison Society, and a large herd is now in existence there. Minnesota has a great deer-preserve in a region of forest, ponds and rocks adjacent to the Canadian line; and a similar refuge for deer exists under State guardianship in the Adirondacks. Greater in extent than all these combined is the grand Canyon National Game Preserve, which embraces the whole region through which the Grand Canyon of the Rio Colorado has been carved. Its area is 2,333 square miles of mountains, plateaus and canyons inhabited by animals that are adapted to the local conditions and could hardly be preserved elsewhere.

For birds about 70 areas have been reserved, including many breeding resorts of sea-birds on the coasts of the Pacific States, British Columbia and Alaska, heretofore raided by egg-hunters; large areas of marshes and lakes in the Pacific States and in the interior necessary as breeding- and feeding-places for western wildfowl and secure refuges for them on their migrations; and many heronries and resorts of shore-birds and ducks in Florida and elsewhere along the Gulf Coast. Similar reservations have been created in Canada and in the insular possessions of the United States. Besides this several of the States, and Provinces have established reserves for animals — notably New York, Pennsylvania, Minnesota, Louisiana and the northern Rocky Mountain States; and in Canada, Quebec, Ontario, Manitoba and Alberta. The Canal Zone is as a whole a bird-reservation; this is the only American one not controlled by the Department of Agriculture and administered by the Biological Survey. It must not be forgotten, also, that the conscientious enterprise of out-door societies of various kinds and of individual citizens have made many private game-preserves and bird-sanctuaries, and in so doing have not only provided local refuges, but have interested and educated the people of the neighborhood. The education of the young and the general interest now felt in animal life in a scientific as well as a humane way is really the greatest safeguard wild life has.

In addition to the federal supervision now exercised in both the United States and Canada to prevent the waste of wild life while enjoying its proper utilization, every State and province has a board of commissioners charged with the same duty, and with the execution of the game laws. These public officials are both aided and criticized by several vigorous organizations, the most powerful of which are The American Game Protective and Propagation Association, The Wild Life Protective Association, The New York Zoological Society, The National Association of Audubon Societies, The Camp Fire Club of America and The Boone and Crockett Club. To this list might well be added the names of a large number of lesser organizations exerting a most useful vigilance and influence locally. Consult the publications of the United States Department of Agriculture, especially those of the Biological Survey and of the Canadian Conservation Commission; also the annual reports of the State game and fish commissions and of the societies listed above. The best guide to further study, and summary of results up to the beginning of the Great War, is to be found in William T. Hornaday's 'Our Vanishing Wild Life' (New York 1913).

ERNEST INGERSOLL.

WILDBAD-GASTEIN, vilt'bād gās'tīn, Austria, a watering-place in Gastein valley, 3,000 feet above the sea, 48 miles south of Salzburg, with thermal springs varying from 64° to 100°, and containing some salt and carbonates of magnesia and lime. The place gives the name to a treaty signed here in 1865 by the emperor of Austria and the king of Prussia, the non-observance of the terms of which led to the German War of 1866.

WILDCAT, any of the smaller species of feline animals (family *Felidæ*, q.v.) in its feral condition; a lynx. The term is a general one applying to all the smaller felines; but locally has usually some specific application. Thus in European books and speech the "wildcat" properly and ordinarily means *Felis catus*, formerly well known in all forested districts from the British Isles to Siberia, and still to be found in the less settled districts of the Continent south of Sweden, though extinct in Great Britain, France and Italy; it is also numerous in northern Scotland. The wildcat is larger, heavier and more strongly built than the domestic cat (to which it has contributed little, if anything: see CAT), has a stouter head and shorter and thicker tail, which does not taper; besides other peculiarities. Its body is yellowish gray, with a dark stripe along the spine, and with numerous darkish stripes descending more or less vertically down the sides, marking the limbs transversely and forming rings around the tail. It is noted for its savagery, and thoroughly tamed examples are very rare, if any ever existed. Like most of the wild felines the female makes her nest in a hollow tree, or cleft of rocks, in an abandoned crow's nest, or some similarly convenient place, and brings forth there in early summer an annual litter of young, which show the ferocity of their native disposition from the start.

Lynxes.— The other European wildcat and the North American wildcats are lynxes, formerly set apart in a separate genus (Lynx); but most modern zoologists do not do so. "The lynxes," says Mivart, "are animals which present a markedly different aspect from that of other cats. Their legs are long, and their tail is, with one exception (that of the caracal), very short. Their ears also are tufted at the tip. The pupil is linear when contracted. The orbits are incompletely surrounded by bone. They have no tooth representing the common cat's first upper premolar, while that answering to its second upper premolar is largely developed. The intestines are also very short . . . Still the above given characters are variable in the cat group. In some cats other than lynxes the tail is short, and some have the ears more or less penciled. Some, as we have seen, have long legs, and in many the upper premolar is wanting. The lynxes, therefore, cannot be separated off as a nominally distinct group of genus. The lynxes are very variable in their color and markings, and the Northern lynx also varies greatly in the abundance of its hair,

fur is dark-brown above, each hair tipped with white, and it is spotted white on the lower parts, with yellow lines forming a V on the face. Central Asia has several notable wildcats, as the manul (*F. manul*), the steppe cat (*F. caudatus*), and Tibetan tiger-cat (*F. scripta*), all of which are handsomely striped or spotted, or both.

American Tropical Cats.— South and Central America are the home of a large variety of small felines, as well as of the puma and jaguar. Of these the most notable are the eyra, ocelot, and jaguarondi (qq.v.) elsewhere described. In addition to these are several of much local interest. The margay or chati (*F. tigrina*) is a widespread and variable species, which is met with from Mexico to Paraguay, in warm and well-wooded lowland regions. Its fur may be a grizzly gray, or vary from that to a fox-red, profusely marked with black spots and rings, which extend along the tail, but do not form rings. There are three upright bars upon each cheek. The margay measures about two feet in length of body, and its tail about 11 inches. Geoffroy's cat (*F. guigna*) is a little known species of southern Brazil. The Pampas cat or straw-cat (*F. pajeras*) is a well-marked form. It is much larger and more robust than a house-cat, with short thick legs, a short, club-shaped tail, thick neck and small head, with great round eyes and very small ears. This appearance of weight and size is largely due to the unusual length of the hair, which is yellowish gray, marked with transverse brownish bands on the body, patches on the face and rings around the tail. It inhabits the open plains of Argentina, and with similar habits has become a curious counterpart of the manul of the Asiatic steppes.

Bibliography.— Mivart, 'The Cat' (New York 1892); Elliot, 'Monograph of the Felidæ' (London 1878–83); Hamilton, 'The Wild-cat of Europe' (London 1896); Blanford, 'Fauna of British India — Mammals' (London 1888); 'Zoology of Persia' (London 1876); Blythe, 'Monograph of the Species of Lynx' (Calcutta 1846); Stone and Cram, 'American Animals' (New York 1902); and standard authorities.

WILDE, wild, **George Francis Faxon**, American naval officer: b. Braintree, Mass., 23 Feb. 1845. He was graduated from the United States Naval Academy in 1864 and in 1864–66 was attached to the Brazil squadron. He received promotion to lieutenant-commander in 1869, to commander in 1885, and while commanding the dispatch boat *Dolphin* in 1885–88 made a trip around the world, the *Dolphin* being the first steel vessel in the United States navy to accomplish that feat. He became captain in 1898, commanded the ram *Katahdin* in the Spanish-American War and later, in command of the *Boston*, he landed the first marine troops ever landed in China, sending them to guard the legation at Peking. He captured Iloilo in the Philippine Islands in 1899, and was placed in command of the *Oregon* in that year. In 1900 he captured Vigan in the Philippines, and he was in command of the *Oregon* when she was grounded on an uncharted ledge of rock in the Pechili Gulf. In 1901–02 he was in command of the navy yard at Portsmouth, N. H., and after 1902 was in charge of the yard at Boston.

WILDE, Jane Francesca Elgee, Lady ("Speranza"), Irish poet: b. Wexford, Ireland, 1826; d. Chelsea, England, 3 Feb. 1896. She was married to Sir William Robert Wills Wilde in 1851. Her literary career began in 1845 with her contributions in prose and verse to the 'Nation.' The publication of her essay 'Jacta alea est,' under her pen-name "Speranza," was made the basis of the unsuccessful prosecution of the editor after the suppression of the *Nation* in 1848. Among her writings are 'Ugo Bassi' (1857); 'Poems by Speranza' (1871); 'Ancient Legends, Mystic Charms, and Superstitions of Ireland' (1887); 'Notes on Men, Women and Books' (1891); 'Social Studies' (1893), etc.

WILDE, Oscar (Fingal O'Flahertie Wills), Irish poet: b. Dublin, Ireland, 1856; d. Paris, 30 Nov. 1900. His father was Sir William Wilde, a noted surgeon, and his mother was Lady Jane Wilde (q.v.). He was graduated from Oxford in 1878, winning the Newdigate prize for English verse. In 1879 he went to live in London, where he soon became the leader of the so-called æsthetic movement and was satirized by Du Maurier as 'Postlethwaith' in *Punch*, and by Gilbert in the opera 'Patience.' He visited the United States in 1882, lecturing extensively on art topics, and later lectured similarly in his own country and in Paris. As an orator he was a flat failure, but he had a faculty of keeping himself in the public eye. His poetry and plays constitute his best claim to recognition. In 1895 he was convicted of a serious moral offense and condemned to penal servitude for two years. During his imprisonment he wrote 'A Ballad of Reading Gaol,' a poem of great force, and 'De Profundis,' published in 1905. After his release he lived mainly in France. His other published works include 'Poems' (1880); 'The Picture of Dorian Gray,' a novel; 'The Happy Prince and Other Tales' (1888); the tragedies 'Guido Ferranti' (1890), and 'The Duchess of Padua'; 'Intentions,' essays (1891); 'Lord Arthur Savile's Crimes, and Other Stories' (1891); 'Lady Windermere's Fan,' 'A Woman of No Importance,' and 'The Importance of Being Earnest,' etc. His comedies are extremely clever, and his poems are characterized by melody of movement and beauty of thought. A complete edition of his poems appeared in 1903. Consult Ransome, A., 'Oscar Wilde: a Critical Study' (London 1912); Douglas, Lord Alfred, 'Oscar Wilde and Myself' (New York 1914); Mason, S., 'Bibliography of Oscar Wilde' (London 1914).

WILDE, Richard Henry, American scholar: b. Dublin, Ireland, 24 Sept. 1789; d. New Orleans, La., 10 Sept. 1847. He came with his parents to the United States in 1797 and settled in Georgia, where he studied law, and in 1809 was admitted to the bar. He was elected attorney-general of his State, and in 1815–17, 1824–25 and in 1827–35 was a member of Congress. He spent the years 1835–40 in Europe, made a special study of Dante and Tasso, and was instrumental in the discovery of a portrait of Dante by Giotto on the wall of the chapel of Bargello. He subsequently

removed to New Orleans, re-engaged in law practice, and in 1844 accepted the chair of constitutional law at the Louisiana State University. He wrote the widely popular poem, 'My Life is Like the Summer Rose,' and also published 'Conjectures and Researches Concerning the Love, Madness and Imprisonment of Torquato Dante' (1842). His poem 'Hesperia,' edited by his son, was published in 1867.

WILDE, Thomas. See TRURO, THOMAS WILDE, BARON.

WILDER, wil'der, **Alexander,** American physician and author: b. Verona, N. Y., 14 May 1823; d. 19 Sept. 1908. He was graduated at Syracuse Medical College in 1850, and in 1852 began an editorial career on the Syracuse *Star* being subsequently connected with the Syracuse *Journal* (1853), New York *Teacher* (1856), and New York *Evening Post* (1858–71). He was an anti-Tweed alderman in New York in 1872, inspector of schools in 1873, and from 1875 to 1895 secretary of the National Eclectic Medical Association, editing 19 volumes of 'Transactions.' He was president of the New York School of Philosophy. Among his published works are 'Secret of Immortality Revealed' (1846); 'Neo-Platonism and Alchemy' (1869); 'Our Darwinian Cousins' (1873); 'Eleusinian and Bacchic Mysteries' (1874); 'Ancient Symbol Worship' (1874); 'Serpent and Siva Worship' (1875); 'Vaccination, a Fallacy' (1879); 'Psychology as a Science' (1884); 'The Soul' (1884); 'Higher Sources of Knowledge' (1884); 'Ethics and Philosophy of the Zoroasters' (1885); 'Ancient Smybolism and Serpent Worship' (1886); 'Later Platonists' (1887); 'Antecedent Life' (1895); 'The Ganglionic Nervous System' (1900); 'Perennial Life' (1902); 'History of Medicine' (1902). He translated and edited 'Iamblichus on Egyptian Mysteries.'

WILDER, Burt Green, American scholar and physiologist: b. Boston, Mass., 11 Aug. 1841. He was graduated from the Lawrence Scientific School at Harvard in 1862, was assistant surgeon in the Union army in 1863–65, and in 1866 was graduated from the medical department at Harvard. He was assistant in comparative anatomy at the Harvard Museum of Comparative Zoology in 1866–67, and in 1867 accepted the chair of zoology at Cornell, which he occupied until 1916, when he was made professor emeritus. In 1874–84 he was lecturer in physiology at the Summer Medical School of Maine. He has made many interesting researches concerning the habits of the spider, and spent much time in an endeavor to secure a simple anatomic nomenclature. In 1885–86 he was president of the American Neurological Association. He has written numerous professional papers, and much miscellaneous literature, besides several hymns and music, and has published in book form 'What Young People Should Know' (1874); 'Health Notes for Students' (1883); 'Physiology Practicums' (1888); 'Health Notes for Students' (1890); 'History of 55th Mass. Infantry' (1918). His best known music is 'The Founders' Hymn' (1907); 'Slumber Song' (1908); 'Last Night' (1909), and 'Old Ironsides' (1912).

WILDER, Marshall Pinckney, American horticulturist: b. Rindge, N. H., 22 Sept. 1798; d. Boston, Mass., 16 Dec. 1886. He was engaged as a merchant in the West India trade at Boston after 1825, in 1839 was chosen to the State legislature, was president of the State senate in 1850, and in 1849 served as member of the executive council. He was prominent in the organization of the Constitutional Union Party, was a delegate to the convention which nominated Bell and Everett in 1860, and throughout the Civil War was a firm supporter of the Union. He founded the Massachusetts Agricultural Society, the Massachusetts Agricultural College, and was active in the movement which resulted in the establishment of the Massachusetts Institute of Technology. He was author of numerous articles on horticulture, and lectured extensively on the subject. Among his published addresses may be mentioned 'The Hybridization of the Camellia and Its Varieties' (1847).

WILDER, Marshall Pinckney, American professional entertainer: b. Geneva, N. Y., 19 Sept. 1859; d. 10 Jan. 1915. His occupation was at first a peddler, and later a stenographer, but he abandoned it in order to become a drawing-room entertainer, in which capacity he became widely popular. Though a hunchback he possessed such a pleasing presence with unfailing good humor that he made friends everywhere. At first he entertained for 50 cents an evening, but in 1883 he went to London, was well received by royalty, and his fame was thus established. In 1899 he began to appear in vaudeville. In 1904–05 he toured around the world. He has published 'People I've Smiled With'; 'The Sunny Side of the Street' (1905); 'Smiling Around the World' (1907).

WILDERNESS, The Battle of the. On 9 March 1864 President Lincoln handed to General Grant his commission as lieutenant-general and two days later placed him in command of all the armies of the United States. Grant made immediate preparations for an early campaign to be conducted simultaneously, east and west. He made his headquarters with the Army of the Potomac. Before coming to the East he had expressed himself as favoring a coast movement south of James River, and an advance on Richmond on that line. After his arrival at Washington and a study of the problem he proposed to act with the Army of the Potomac on what was known as the overland route from the Rapidan to the James, while General Butler, with 30,000 men, should ascend James River from Fort Monroe and establish himself in an intrenched position near City Point, whence he could operate against Richmond and its communications with the south, and at a proper time form a junction with the Army of the Potomac, moving down from the north. At the same time General Sigel, commanding troops in West Virginia and the Shenandoah Valley, was instructed to form two columns, one of 10,000 men, under General Crook, to move from the Kanawha and operate against the Virginia and East Tennessee Railroad, the other 7,000 strong, under Sigel, in person, to advance, as far as possible, up the Shenandoah Valley, to draw detachments from Lee. Grant's main reliance, however, was the

velopments. Warren had started early in the morning for Parker's Store, on the Orange plankroad, and when near it Crawford's division had been ordered to halt in a good position on high ground, and finding that Wilson's cavalry at Parker's Store needed assistance Crawford threw forward a skirmish line that encountered the flankers of A. P. Hill's corps.

Soon after 8 A.M. Crawford was informed by Warren that Griffin's and Wadsworth's divisions would attack Ewell on the turnpike and he was ordered to join in it with one of his brigades. Between 9 and 10 A.M. Hancock was ordered to move up the Brock road to the Orange plankroad and be prepared to move out that road toward Parker's Store, and about the same hour three brigades of General Getty's division of Sedgwick's corps were ordered from the Wilderness Tavern to the intersection of the Brock road with the Orange plankroad, and directed to move out the latter road and attack the enemy, and, if they could, drive them back beyond Parker's Store. As described by Humphreys, "The Brock road begins on the Orange pike about a mile east of the old Wilderness Tavern, and runs in a southeast direction to Spottsylvania Court House, intersecting the Germanna plank, the Orange plank, the Furnace, the Catharpin and other roads running in a southwest and south direction." Ewell had formed for battle across the Orange pike when about noon Warren opened the attack. Griffin's division advancing on both sides of the pike struck Johnson's division, broke it and drove it back. Rode's division was thrown in on Johnson's right, south of the pike, and supported by Early, who was formed across the pike, the line was re-established. After a severe and bloody fight Griffin was driven back, losing many prisoners and two guns. Wadsworth's division, which had advanced on the left of Griffin, lost direction, exposed its left and was thrown back in confusion. McCandless' brigade of Crawford's division, attempting to unite with Wadsworth's left, was nearly surrounded by Ewell's right and fell back with heavy losses, and Crawford's entire division had to be drawn in.

Thus all the ground gained by Warren was given up and he assumed a new line somewhat in rear, but still in front of Wilderness Tavern, with his right on the Orange pike. He had lost more than 3,000 men. On his right General Wright's division of Sedgwick's corps came up early in the afternoon and with Neill's brigade of Getty's division formed within 300 yards of Ewell's front and repulsed one of his attacks. Soon after this Seymour's brigade of Rickett's division came up on the right of Neill, and about 5 P.M. two brigades of Sedgwick attacked Ewell's left and were repulsed. Meanwile General Getty, who had arrived at the crossing of the Brock road and the plankroad, had been ordered to attack. Heth's Confederate division was in his front supported by Wilcox's. Hancock, who had been ordered from Todd's Tavern, 10 miles distant, by the Brock road, was instructed to support Getty, drive A. P. Hill beyond Parker's Store and connect with Warren's left. It was 3.15 P.M. when Getty received his order to attack. Meanwhile Hancock's advance had arrived and began intrenching on the Brock road. At 4.15 Getty advanced to the attack through the thick woods and had gone less than 400 yards beyond the Brock road, when he became hotly engaged with Heth's division. Although Hancock had not completed his dispositions he moved forward to Getty's support and the fight became fierce and deadly at very close quarters and continued until near 8 P.M., when darkness put an end to the fierce contest. Hancock had not gained much ground, but Hill's lines had been broken and his right driven back by two brigades of Barlow's division. While Hancock and Getty were engaged, Wadsworth's division had been ordered in a southeast direction to strike the flank of the Confederates engaging them, but did not become seriously engaged and was halted by darkness, about a half mile from the Brock road.

The Union army had fought in detachments, with no connection of its corps or divisions. Grant said that he had never seen such hard fighting, but prepared to renew it next day, and Hancock, Warren and Sedgwick were ordered to attack at 5 o'clock next morning, and Burnside was ordered to have two divisions in position between Warren and Hancock so as to advance with them. Each corps commander was advised of the instructions given to the others. To note briefly the action of the cavalry on the 5th: Wilson's division, after leaving 500 men at Parker's Store, had proceeded toward Craig's Meeting House on the Catharpin road, and was driven back on that road as far as Todd's Tavern. General Gregg had found nothing at Fredericksburg, but had discovered two brigades of cavalry falling back from Hamilton's Crossing to Lee's right flank, and fell back to Todd's Tavern before 3 P.M. to check the enemy pursuing Wilson and drove them back beyond Corbin's Bridge.

During the night of the 5th Ewell's and Hill's corps strengthened their intrenchments and put artillery in position, and a few minutes before 5 A.M. of the 6th opened the second day's fight by an attack upon the Union right, which was promptly met by the advance of Wright's division of the Sixth corps, which made two vigorous assaults against the Confederate left, which were repulsed with severe loss. Warren made several attacks on Ewell's right which were repulsed. These persistent and unsuccessful attacks were continued until after 10 o'clock, when Sedgwick and Warren were directed to suspend them, to strengthen their intrenchments and throw up new works, in order that a part of their troops might be available for an attacking force to move from the vicinity of Hancock's right, which had been desperately engaged. Hancock had disposed Gibbon's and Barlow's divisions, both under command of General Gibbon, to defend his left flank against an apprehended attack by Longstreet, and at 5 A.M. launched Birney's, Mott's and Getty's divisions, all under General Birney, along the Orange plankroad, Wadsworth's division of Warren's corps at the same time advancing on Birney's right. They fell upon Heth's and Wilcox's divisions of Hill's corps with great fury and after a desperate contest broke them and drove them a mile and a half, through the dense woods, under heavy loss, and back on the trains and artillery, and General Lee's headquarters. Just before Hill's troops gave way the head of

Longstreet's corps, which had marched nearly all night, came upon the field at Parker's Store and was hastened along the plankroad to relieve the divisions of Heth and Wilcox. Kershaw's division was in the lead and began to form on the right of the road.

Humphreys says: "The advance through the forest, underbrush, and swamps more than a mile, in a hot contest, had separated and disordered Hancock's corps, and Birney's left, met in this condition by Kershaw's division, was not only brought to a standstill, but at some points swayed back and forward, until at length Kershaw, himself leading his division, forced Birney's left back as far as his center. Wadsworth's advance had crowded many of Birney's troops to the south side of the plankroad, so that the greater part of his, Birney's, command was on the left of that road. Field's division of Longstreet's corps following close on Kershaw's division, some of it coming on the ground at double-quick, was formed on the Confederate left of the plankroad, and, advancing, at once became hotly engaged with Birney's right and Wadsworth's troops, Gregg's Texans and Benning's Georgians in the lead, bearing the brunt of the fight and losing heavily in killed and wounded. R. H. Anderson's division of Hill's corps, following Field's division, formed on the same part of the line, one portion uniting with Field's troops in the attack, the other portions supporting. It was when Hancock's troops were partially checked by the fresh troops of Longstreet that the necessity of readjusting his formation became imperative. Regiments were separated from their brigades and mixed with others, and the line of battle was very irregular, and commanders were in this way losing the control of their troops. This was about half past six o'clock."

At 9 A.M. Hancock again attacked with the divisions of Birney, Mott, Wadsworth, Stevenson's of Burnside's corps, and three brigades of Gibbon's division and though fighting furiously made no headway, and at 11 o'clock the firing on his front died away. Meanwhile Longstreet had discovered that Hancock's left extended but a short distance from the plankroad and he moved a part of his command to the right to attack Hancock's left and rear, the flank movement to be followed by a general advance of his entire corps. The attack first fell on the left of the advanced line held by Frank's brigade, partly across the Brock road, which was fairly overrun and brushed away; it then struck the left of Mott's division, which in turn was driven back in confusion to the Brock road, and the confusion spread to the troops on the right, and Hancock was compelled to withdraw his entire corps to the Brock road, from which they had advanced in the morning, where they were reformed in two lines behind their intrenchments. Wadsworth, on the right of Hancock, made heroic efforts, but his troops broke, and while striving to rally them he was mortally wounded and died within the Confederate lines next day. When this movement had succeeded Longstreet ordered a general advance, and while riding at the head of column, moving by the flank down the plankroad, when opposite the force that had made the flank movement, which were drawn up parallel with the road, about 60 yards from it, a volley was fired which killed General Jenkins, commanding the leading brigade of Field's division, and severely wounded General Longstreet. Lee soon came up, postponed the attack to a later hour and extended his line so that its right rested on the unfinished Orange Railroad.

Meanwhile a brigade of the Ninth corps, which had been sent to the left, under Gibbon, swept down in front of Hancock's line from left to right and cleared it of the enemy. In the action of the previous day there had existed an interval between Warren on the turnpike and Hancock on the plankroad, through which Burnside was expected to advance and attack Hill and Longstreet in flank, but in advancing through the woods the enemy was encountered on a wooded crest near the plankroad. An attack was not deemed advisable and Burnside's troops were moved farther to the left. It was not till afternoon and after Hancock's repulse that they became engaged, without accomplishing much, and toward evening they fell back and intrenched. The lull that had followed the successful attack of Longstreet gave Hancock time to re-establish his position now strengthened by fresh troops sent by Meade, and Hancock was directed to renew the fight at 6 P.M. But again Lee anticipated the Union commander, and at 4.15 P.M., having gotten well in hand the troops of Longstreet and Hill, he advanced in force against Hancock's intrenched lines, until he came within 100 yards of the front one, when he opened a severe fire, which was heaviest on Hancock's left, and at the end of half an hour a portion of Mott's division and of a brigade of Birney's gave way in disorder.

The moment this break occurred the Confederates pushed forward and Anderson's brigade of Field's division took possession of that part of the first line of intrenchments and planted their colors on them. Near the point where the line was broken through a fire had, during the afternoon, sprung up in the woods, and at the time of Lee's attack had communicated to the log breastworks on that part of the line. At the critical moment they became a mass of flames, which could not be extinguished and which extended for many hundred yards to the right and left. The heat and smoke were driven by the wind into the faces of the Union troops, preventing them on portions of the line from firing over the parapet, and at some points obliged them to abandon it. It was this condition of affairs that permitted Anderson's brigade to seize a part of the breastworks, from which they were quickly driven by Carroll's brigade, which was near at hand and which rushed upon them at the double-quick. By 5 P.M. Lee's troops had been completely repulsed on Hancock's front, and fell back with heavy losses in killed and wounded.

Just before dark Ewell moved two brigades of Early's division around the right of Sedgwick's corps, held by Ricketts' division, and in co-operation with the rest of Early's division, succeeded in forcing Ricketts back in some confusion, capturing Shaler and Seymour, brigade commanders, and a large number of their men. Wright's division, also, was thrown into some disorder but Wright restored order

and Early drew back and formed a new line in front of his old one.

During the night an entirely new line was taken up by the Sixth corps, its front and right thrown back, a change which was conformed to by the right of the Fifth corps. On the left Sheridan's and Stuart's cavalry had some severe fighting at and near Todd's Tavern in which Sheridan had the advantage. On the morning of the 7th reconnaissances were made of the Confederate position which was found well intrenched; neither commander showed any disposition to renew the fight on that field, and Grant decided to continue the movement by the left flank, and when darkness came the Union columns began their march for Spottsylvania Court House (q.v.). The Union troops engaged numbered about 101,000; the Confederates numbered about 60,000. The Union losses, as officially reported, were 2,246 killed, 12,037 wounded and 3,383 missing, an aggregate of 17,666. The Confederate reports are very incomplete; the most reliable estimate places their entire loss at 7,750.

Bibliography.— 'Official Records' (Vol. XXXVI); Humphreys, 'The Virginia Campaign of 1864-65'; The Century Company's 'Battles and Leaders of the Civil War' (Vol. IV); Swinton, 'The Army of the Potomac'; Walker, 'History of the Second Army Corps'; Grant, 'Personal Memoirs' (Vol. II); Pennypacker, 'Life of General Meade'; Long, 'Life of General Lee'; Gordon, 'Reminiscences of the Civil War.'

E. A. CARMAN.

WILDERNESS ROUTE, in American history, a famous emigrant road or trail from the Atlantic seaboard to Ohio through Cumberland Gap. Thousands of emigrants passed over this road to Ohio and Kentucky. The "Wilderness Road" was marked out by Daniel Boone. In 1775 the Transylvania Company, with Col. Richard Henderson as head, engaged Boone to mark out a road from Fort Wautaga, on a branch of the Holston, to the Kentucky River, where the company's newly-purchased lands lay. "This I accepted," wrote Boone, "and undertook to mark out a road in the best passage through the wilderness to Kentucky with such assistance as I thought necessary to employ for such an important undertaking."

WILDES, Frank, American naval officer: b. Boston, Mass., 17 June 1843; d. on steamer *China*, off San Francisco, Cal., 6 Feb. 1903. He was graduated from the United States Naval Academy in 1863, served in the West Gulf squadron, and later on the monitor *Chickasaw*. He was promoted master in 1866, became commander in 1880, was in charge of the Portsmouth, N. H., navy yard in 1885-88, and in 1894 was commissioned captain. He commanded the cruiser *Boston* at the Asiatic Station in 1895-98, and served under Dewey at the battle of Manila, 1 May 1898. In 1901 he was advanced to the grade of rear-admiral, was assigned to the Asiatic Station as junior squadron commander, and in 1903 was ordered home on sick-leave, but died on the way.

WILDFOWL, in modern usage, waterbirds, as ducks, geese and swans, pursued by gunners for sport or for market. American methods of wild fowling will be found where these birds are described. (See DUCKS). An interesting method in Europe, still extensively pursued in some parts of England, at the Fens, is by decoying wild ducks in large trap-ponds. The pond is constructed in a secluded place, well sheltered by trees, and with a plentiful supply of reeds and sedges. From this pond pipes or narrow passages are led, 60 to 80 yards, gradually narrowing toward the termination. Above, the pipe is bridged and covered by a light network, and at its termination it ends in a tunnel net, which is, as a rule, carried out on to the land. Decoy ducks, which come to be fed at the call of the attendants, are used to entice their wild neighbors into the pipe; but the decoy dog is perhaps a more valuable ally of the fowler. This dog is named a "piper." It is of a small breed, and indulges in playful gambols by the side of the pipe, appearing now and then in advance of the fowl, which, led by curiosity, swims onward toward the dog, and is thus drawn toward the terminal net. The dog preserves a perfect silence during its manœuvres. Devices of the same character are used in the Orient, especially in Japan. Another Old World method is by employing the stalking horse, still used in some parts of England; the body of the horse — which requires special training for its work — being used to conceal the sportsman from the game. Consult Sanford and Van Dyke, 'Water Fowl,' American Sportsman's Library (New York 1903); Grinnell, 'American Duck-shooting' (New York 1901); Elliot, 'The Wild Fowl of the United States, Etc.' (New York 1898); Mayer, 'Sport with Rod and Gun' (New York 1892); Aflalo, 'Sport in Europe' (London 1901); Hornaday, W. T., 'Our Vanishing Wild Life' (New York 1913); the files of *Outing*, and 'Bulletins' of the United States Bureau of Biological Survey (Washington, D. C.)

WILES, Irving Ramsay, American artist: b. Utica, N. Y., 8 April 1861. He was the son of Lemuel L. Wiles, also an artist and director of fine arts at Ingham University, Le Roy, N. Y. He studied under his father and at the Art Students League, New York, and under Carolus-Duran in Paris in 1882-84. He afterward established himself in New York and specialized in the painting of figures and portraits. His fine conception of line and coloring and his strong and sympathetic characterizations have gained him a high place among American artists. He was elected to the National Academy in 1897. He received gold medals at the expositions at Buffalo (1901); Saint Louis (1904); Buenos Aires (1910); and at San Francisco (1915); and was awarded the Proctor portrait prize at the National Academy of Design. Among his paintings are 'Golden Dreams' (Saint Louis Museum), 'Shelter Island, Summer' (Metropolitan Museum, New York); 'The Student' (Corcoran Art Gallery, Washington); 'Russian Tea' (National Gallery, Washington); 'Julia Marlowe,' portrait (1903); 'Mrs. Gilbert,' portrait (1904); 'Lemuel Maynard Wiles,' portrait (Metropolitan Museum, 1904); 'George A. Hearn,' portrait (Metropolitan Museum, 1914), etc.

WILEY, Harvey Washington, American chemist: b. Kent, Ind., 18 Oct. 1844. He was

graduated from Hanover College in 1867; from the Indiana Medical College in 1872; from Harvard in 1873, and in 1878–79 studied abroad, chiefly at the University of Berlin. He was professor of chemistry at Purdue University in 1874–83, and in 1881–83 was also State chemist of Indiana. In 1883 he became chief chemist of the United States Department of Agriculture, occupying also the position of professor of agricultural chemistry at the graduate school of Columbia University from 1895. He was secretary of the Association of Official Agricultural Chemists in 1889; was president of the American Chemical Society in 1893–95, and was sent to Europe several times as the leading American scientist on the chemistry of foods. He made a specialty of sugar and glucose investigations and was interested in the prevention of food adulteration. In this work he was so active, and wrote so much against the use of artificial "preservatives" in foods, that he gradually antagonized the leading food companies of the country, and through political pressure was removed from the Department of Agriculture. He is deserving of high commendation for his long fight to help keep pure the food of the nation. He has published 'Songs of Agricultural Chemists' (1892); 'Principles and Practices of Agricultural Chemistry' (3 vols., 1894–97); 'Foods and Their Adulterations' (1911); 'The Lure of the Land' (1915), and the 'Bulletins' of the United States Department of Agriculture, etc.

WILEY UNIVERSITY, an institution for the education of the colored race, located in Marshall, Tex. It was founded in 1873 by the Freedmen's Aid and Southern Educational Society of the Methodist Episcopal Church, by which it is now chiefly supported. It is open to both men and women. It has elementary, secondary and collegiate departments, and normal, commerical and industrial courses. The Collegiate Department confers the degrees of A.B. and B.L. Industrial work and instruction is given in carpentry, bricklaying, printing, sewing and cooking. The grounds and buildings in 1909 were valued at $60,000; a building for general purposes was erected in 1900–01. The income in 1917 amounted to $28,000; the library contained 6,000 volumes; the students numbered 400, and the faculty 26.

WILFRID, or WILFRITH, Saint, Anglo-Saxon prelate: b. about 634; d. Oundle, Northamptonshire, 709. He studied at Lindisfarne, became a monk, and in 653 accompanied Benedict Biscop to Rome in order to obtain an authoritative answer to the question of the proper time for celebrating Easter. On his return he obtained from Alchfrid, king of Northumbria, a grant of land and a monastery at Ripon, and here he was ordained priest in 664. In this same year he took a leading part in the conference at Whitby, where he persuaded the king to decree that, in the celebration of Easter, the Roman usage should be substituted for that of the Scottish Church, which had hitherto prevailed in Northumbria. At this time also the king appointed him archbishop of York, but having gone to France to be consecrated by a bishop holding orthodox views on the Easter question, he found on his return that his see was occupied by one of the opposite party, and he did not get possession till 669. Becoming obnoxious to King Egfrid (who had succeeded Alchfrid in 670), the king, to reduce his influence, divided his diocese into three, and when Wilfrid opposed this proceeding, deprived him of his see altogether (678). Wilfrid thereupon set out for Rome to obtain from the Pope a reversal of the king's act of deposition. Having been driven by a storm on the coast of Friesland, he preached to the people (who had no difficulty in understanding the Anglo-Saxon) with such effect that all the princes and many thousands of the people offered themselves for baptism. Having reached Rome he easily obtained from the Pope the desired decision, but during the reign of Egfrid remained under persecution or in exile; in 687, however, Aldfrid, who had succeeded Edfrid, reinstated him. But Aldfrid also in course of time was offended by his devotion to Rome, and Wilfrid was again deposed in 691. He then made another journey to Rome, and did not return till 705. Consult Eddis, 'Vita Wilfridi,' in 'Historians of York' (Vol. 1, 'Rolls Series'); Bright, 'Early English Church History' (3d ed., 1897); Hunt, 'The English Church from its Foundation to the Norman Conquest' (1899).

WILGUS, William John, American railroad engineer: b. Buffalo, N. Y., 20 Nov. 1865. He studied civil engineering and entered railroad service in 1885; and was later division engineer of construction on the Minnesota and Northwestern Railroad. He was in charge of the construction of the Chicago Union Transfer Railroad in 1890–93; and in 1893–1907 he was with the New York Central Railroad. He was chief engineer of construction with that railroad in 1899–1903; and later, as vice-president in charge of construction on the New York Central, he superintended the electrification of the lines within a certain radius of New York. He was chairman of the board of engineers constructing the tunnel under the Detroit River. Since 1908 he has been established as a consulting engineer. He was appointed major in the Engineering Reserve Corps of the United States in 1917, and was later colonel in the Railway Transportation Corps with the American Expeditionary Force in France. He was awarded the Rowland prize of the American Society of Civil Engineers in 1909 and the Telford medal of the Institute of Civil Engineers, London, in 1911. He has published 'Physical Valuation of the Railroads' (1913).

WILHELM MEISTER, Goethe's greatest novel, consists of 'Wilhelm Meister's Apprenticeship,' published in 1796, and 'Wilhelm Meister's Travels or the Renunciants,' published in final form in 1829. Both parts of the novel deal with the adventures of a young man and the development of his character, each part, however, being conceived from a different point of view. In the 'Apprenticeship' Wilhelm Meister, the son of a well-to-do merchant, decides to join a band of strolling actors, both from personal enthusiasm for their profession and for the noble purpose of raising the German stage to a higher level. But he realizes, after some time, that he is not a born

actor; the company to which he belongs can not keep up the high standard which it had reached in the presentation of Shakespeare's 'Hamlet' (book 5), and makes the stage a place of cheap amusement instead of a place of education; the life of the actors is of an indifferent, drifting nature, depending on the opportunities of the moment. Wilhelm withdraws from the stage and feels more at home with a certain secret society — The Society of the Tower — whose members as a rule belong to the nobility. Real culture and superior skill in worldly matters can be found among them. The high goal which they pursue in the education of man is to develop and to reconcile with each other all the qualities with which the individual is endowed by nature. The common problem which all men have to solve in the course of their lives is the reconciliation of the moral and the sensual, the ideal and the real, while art and perhaps religion are considered the means for attaining such a complete, harmonious personality. Man is to make himself a work of art which, independent of its surroundings, has its object exclusively in itself. Against this inspiring conception of man by which Wilhelm is attracted and which his fiancée Natalie and to some extent also her aunt represent (Cf. 'Confessions of a Fair Saint,' book VI), stand out the pathetic figures of Mignon and the harper, who are doomed to a tragic end. Characteristic features of Germany in the 18th century are the separation of classes into nobles and commoners, the conception of the theatre as a place of education, and the tendency to form secret societies. The construction of the 'Travels' is decidedly loose. Wilhelm himself no longer plays so prominent a part; reflections and maxims, descriptions of conditions and institutions take up a great deal of space, and a number of short stories but vaguely connected with the main story are inserted at different places. The whole is conceived in a new spirit, the spirit of renunciation, the power of which every individual must experience in the course of his life and without which mutually beneficial relations with our fellowmen cannot be established. Accordingly a new standard is set up for the individual and for society. Above all, the individual is to be made a useful member of society, and to this end it is necessary that he should confine his best efforts to one definite activity; Wilhelm chooses surgery for his specialty. The separation of classes, already disregarded at the end of the 'Apprenticeship,' where marriages between nobles and commoners are contracted, is set aside for democratic ideas in the 'Travels' where noblemen in leading positions consider themselves no better than their fellow-workers. The feeling between men has become wider and freer, and so has the feeling between countries. While, in the first part of the novel, emigration to America is rejected, the second part pronounces both emigrating and staying at home equally good, indeed the chief characters — among them Wilhelm — make up their minds to go to America. For good men are at home anywhere where they are useful. A world-society is hoped for which will inform its members about all parts of the world and foster in them a "world-piety" which respects all forms of religion and government serving mankind while fulfilling their special tasks. The individual, æsthetic man of the 18th century is replaced by the social, practical man of the 19th century; the ideal of the harmony of the individual is eclipsed by the ideal of the harmony of the world. We see the author of 'Wilhelm Meister' like the colossal mythical statue of Apollo at Rhodes standing as it were on the shores of two centuries. Consult edition of Goethe's works in 'Deutsche National-Literatur' (Vols. XV–XVI, 1882–98); 'Wilhelm Meister's theatralische Sendung' (1911); English translations in 'Everyman's Library,' by Carlyle, and in 'Bohn's Libraries.' Bielschowsky, 'Goethe' (Vol. II, 26th edition, pp. 128–183, 513–568); Creizenach, introductions and notes in 'Goethe's Sämtliche Werke, Jubiläums-Ausgabe' (Vols. XVII–XX).

EWALD EISERHARDT.

WILHELM TELL. Schiller's most popular play, if not his best, is 'William Tell,' of which more copies have been sold than of any other German work of literature. During the years 1899 to 1905 a yearly average of 232 stage performances in German lands was maintained, a record equalled by no other German drama. Many critics condemn its structure, others find Tell's slaying of the tyrant Gessler from ambush morally indefensible; but it has become the national poem of the Swiss people. Read and seen on the stage in Germany's dark days it inspired the revolt against the despotism of the great Napoleon, and again in 1848 and later in 1870 its powerful influence was felt and the Rütli oath became the motto of the new empire. On the 100th anniversary of Schiller's birth in 1859 the 'Urkantone' dedicated the immense Mytenstein near the Rütli "To Schiller, Tell's Singer."

Although every child knows the story of Tell's appleshot, it is not Tell but the Swiss people who are the heroes of the drama, or more exactly the three forest cantons Schwyz, Uri and Unterwalden, who by their historical defeat of the forces of the duke of Austria at Morgarten in 1315 and by later victories made themselves independent of the House of Habsburg while remaining in the empire down to the Thirty Years' War. Still, the drama is built about the Tell legend, for history knows no Tell, nor any tyrannical Gessler, nor was there any revolt against Kaiser Albrecht, as in the drama, which follows the chronicle of Ægidius Tschudi (1505–72). The legend, itself, most probably came we know not how, from the Dane Saxo Grammaticus, who wrote in the 12th century, but long before Goethe's visit to the Forest Cantons in 1797, it had been accepted by the Swiss as fact. Goethe had wished to treat the subject in an epic, but resigned it to Schiller for dramatic treatment, helping him with all his data and knowledge of Swiss customs, topography and local color, for Schiller never saw Switzerland. It was finished and first produced in March 1804, and rapidly made its way over delighted Germany, but was not tolerated in Vienna till 1827.

In their revolt against Habsburg tyranny, representatives of the three original cantons met on the Rütli and swore their "desire to be a united people of brothers, to be separated

in no trial and danger; to be free as their fathers were; to suffer death rather than live in servitude; to trust in God on high and not to fear the power of men.' Hence Schiller carried three parallel plots, of which Tell, the yeomanry and the nobles were the protagonists, but all blend into one compact whole, leading from a common revolt against tyranny to common success.

The noble blank verse, the occasional lyrics and the striking scenery conspire to make a drama of irresistible charm, such that amateur actors give the play twice a week during the summer at Altorf to never-diminishing audiences.

Editions: Schiller's 'Werke,' 'Goedeke,' etc., 1868–76 (Vol. XIV); 'Säkular-ausgabe' (Vol. VII); American school editions: E. C. Roedder, 1905; Arthur H. Palmer, 1915, and a dozen others. Consult Bulthaupt, Heinrich, 'Dramaturgie des Schauspiels' (Vol. I); Kuenen, E., 'Schiller's Wilhelm Tell, erläutert und gewurdigt.' There is an English translation by E. B. Lytton, 1844, and nearly 20 others.

CARL E. EGGERT.

WILHELMINA I, vĭl-hĕl-mē'nä **(Wilhelmina Helene Pauline Marie),** queen of the Netherlands: b. The Hague, 31 Aug. 1880. She is the daughter of King William III of the Netherlands by his second wife, Emma of Waldeck. She became queen on the death of her father in 1890, but as she had not attained her majority her mother ruled as queen-regent; Wilhelmina meanwhile was carefully educated under the best tutors. Shortly after her 18th birthday, on 6 Sept. 1898, she was crowned queen at Amsterdam. Her charming personality and strength of character have made her very popular with her people; she has also been strongly influenced by her mother, who is equally well loved by the people. In February 1901 she was married to Henry Frederick, Duke of Mecklenburg-Schwerin; and 30 April 1909 she became the mother of Juliana, Duchess of Mecklenburg.

WILHELMSHAVEN, vĭl'helms-hä-fĕn, Germany, town and naval station, on the northern coast of the duchy of Oldenburg, at the west entrance of the Bay of Jade, 40 miles northwest of Bremen, with which it is connected by rail. In 1853 the land was bought from Oldenburg by Prussia, and the town laid out in 1856; it was first used as a naval station in the Franco-Prussian War, and since then has been made a fortress of the first rank. The harbor and fortifications were built at great cost, as the ground is soft and marshy and without natural advantages. The harbor basin, which is artificially constructed and walled with granite, is connected with the bay by a canal and contains three large dry docks; it is defended by forts of immense strength and provided with a torpedo station. The naval workshops were located here; it was one of the most important naval stores of the German empire in the World War. There is also a commerical harbor connected with the naval harbor, but the town has not attained commercial importance. Pop. about 36,000.

WILIBRORD, wĭl'ĭ-brôrd, or **WILLIBROD, Saint,** English missionary, called the Apostle of the Friesians: b. Northumbria, about 657; d. about 738. He was brought up in Saint Wilfred's monastery at Ripon, spent 13 years in Ireland, and at 33, with several associates, embarked as a missionary for Friesland, where he was warmly welcomed by the Franconian prince, Pepin. Wilibrord made two visits to Rome (692 and 695), and on the latter occasion was made bishop by Pope Sergius over all the converted Friesians. In that part of Friesland under the rule of the Franks, he founded many Christian churches, some of which were destroyed a few years later in consequence of the successes of the pagan Friesians. He was buried in the monastery of Echternach, near Treves, and is commemorated in the Roman Catholic Church on 7 November.

WILKES, wĭlks, **Charles,** American naval officer and explorer: b. New York, 1798; d. Washington, 8 Feb. 1877. He entered the navy as a midshipman in 1818, served on the Mediterranean Station in 1819–20, in the Pacific 1821–23 and was then selected for separate command. In 1826 he was promoted lieutenant, and in 1830 was appointed to take charge of the government charts and instruments. In 1838 he was put in command of an expedition for exploring and surveying the Southern seas, the first scientific expedition ever fitted out by the United States government. During the next five years the expedition visited Madeira, Rio de Janeiro, Tierra del Fuego, Chile, Peru, the Paumota group, Tahiti, Tutuila and the Samoan group, New South Wales, the Antarctic regions, New Zealand, the Fiji group, the Sandwich (Hawaiian) Islands, the Columbia River, Willamette Valley, the coast of California, the Philippine Islands, Sulu Archipelago, Saint Helena, Singapore and the Polynesian Islands. The results of the expedition were published in 19 volumes, those on 'Hydrography' and 'Meteorology' being written by Wilkes himself, who also wrote the 'Narrative of the United States Exploring Expedition' (1845). Wilkes claimed to have discovered an Antarctic continent, but the claim was long disputed. Shackleton's recent discoveries tend to prove the accuracy of Wilkes' announcement. In 1843 he was made commander, in 1855 a captain, and at the beginning of the Civil War in 1861 was placed in command of the *San Jacinto,* in which he went to the West Indies in search of the Confederate vessel *Sumter.* On 8 November of that year he took the Confederate commissioners Mason and Slidell from the British mail steamer *Trent.* (See TRENT AFFAIR, THE). In 1862 Wilkes was in command of the Potomac flotilla and afterward of the flying squadron that operated against blockade-runners. In July 1862 he was promoted commodore, in 1864 was placed on the retired list, and thereon in July 1866 became rear-admiral. Besides those above mentioned his publications are 'Western America, Including California and Oregon' (1849); and 'The Theory of the Wind' (1855).

WILKES, John, English politician: b. London, 1727; d. December 1797. He was the son of a wealthy distiller and was educated at the University of Leyden. In 1757 he was returned to Parliament as member for Aylesbury and in 1762 attained considerable reputation by the publication of a paper entitled the *North Briton,* in which the administration of Lord

Bute was severely attacked. These papers hastened the resignation of Lord Bute, April 1763, and the same month the *North Briton* commented on the king's speech in such caustic terms that a prosecution was determined upon. Wilkes, among others, was apprehended; but he asserted the illegality of the warrant and refusing to answer interrogatories was committed to the Tower. Some days after, he was brought by writ of habeas corpus before the court and ordered discharged on the ground that his privilege as a member of Parliament had been violated. On the next meeting of Parliament, however, a special law was passed to sanction Wilkes' prosecution, and in January 1764 he was expelled from the House of Commons. A second charge was also brought against him for printing an obscene poem, entitled an 'Essay on Women,' and he was found guilty of blasphemy as well as libel. As he had by this time withdrawn to France and did not appear to receive sentence, he was outlawed. He made vain attempts to procure the reversal of his outlawry, but trusting to his popularity ventured to return on a change of ministry (1768). He was elected to Parliament for Middlesex, but before he could take his seat was committed to prison to fulfil the sentences previously passed upon him, and not long after was expelled from the House for an alleged libel upon the Secretary of State and Secretary at War. Three times after this he was re-elected within a few months, but the House of Commons persisted in keeping him out, and after the third election the other candidate, although he had got but a small minority of the votes, was declared duly returned. In 1770 he was released from his imprisonment. He was now more than ever the idol of the people. He was elected alderman of London, sheriff of Middlesex, and finally mayor (1774). In 1774 he was again elected to Parliament for Middlesex and allowed to take his seat, which he held till 1790. His last triumph was obtained in 1782, when the resolutions respecting the disputed Middlesex elections were ordered to be expunged from the journal of the House of Commons. From the year 1779 he was chamberlain of the city of London. Wilkes, as a writer and speaker, did not reach beyond mediocrity. His private character was very licentious, but he possessed elegant manners, fine taste, ready wit and pleasing conversation. His 'Letters and Speeches' were published by himself in 1786; and much light is thrown upon his conduct by the 'Letters from the Year 1774 to the Year 1796 to His Daughter' (1894). His correspondence was also published (1805), with a memoir by Almon. Consult Fitzgerald, 'The Life and Times of John Wilkes, M.P.' (1888).

WILKES-BARRE, Pa., county-seat of Luzerne County and regarded by many as the most beautiful city in the State, on the north branch of the Susquehanna River, and on the Central Railroad of New Jersey, the Wilkes-Barre and Eastern, the Delaware and Hudson, the Wilkes-Barre and Hazleton, the Delaware, Lackawanna and Western, the Lehigh Valley, the Lackawanna and Wyoming Valley and the Pennsylvania railroads, 110 miles northwest of Philadelphia and 110 miles west of New York City. It was first settled in 1769 by New England people, mainly from Connecticut, under the auspices of The Susquehanna Company, and was named in honor of John Wilkes and Isaac Barré (qq.v.), members of the British Parliament. During the Revolutionary War the settlers were, with few exceptions, loyal to the patriot cause. July 3, 1778, the male inhabitants of Wyoming Valley, who were assembled at Forty Fort to repel an invading foe, were attacked near the fort (on Abraham's Plains, some seven miles from Wilkes-Barre) by a battalion of British Rangers with their Indian allies, and were badly defeated. The Wyoming Monument, erected near the field of battle, commemorates the valor of the Americans who fought on this bloody field. Following the surrender of Forty Fort, on 4 July 1778, Wilkes-Barre was almost wholly destroyed by the enemy. Wilkes-Barre was, in the period of 1769 to 1784, the centre of the controversy between Connecticut and Pennsylvania, each State claiming territorial jurisdiction over the Wyoming region (see PENNSYLVANIA, *History*) and was the scene of several conflicts during that controversy, being almost entirely destroyed by fire at one time in 1784. It was gradually rebuilt and was incorporated as a borough in 1806; its growth has been rapid since the Civil War; and in 1871 it was incorporated as a city. It is situated near the centre of Wyoming Valley, in the midst of picturesque scenery. Wilkes-Barre is the birthplace of the anthracite coal-mining industry. It was here the discovery was made that there existed on this continent such a mineral as anthracite (or "stone coal" as it was early called). Here anthracite was first used for fires in naileries and blacksmiths' shops; and was thus used for upward of 20 years before the existence of anthracite in any part of Pennsylvania save Wyoming Valley was known. Here anthracite first came into use as a fuel for domestic purposes. Wilkes-Barre lies in the seventh anthracite mining district of Pennsylvania and from the 37 mines and washeries in operation in the district there are produced annually about 5,000,000 tons of coal. The manufacturing and mechanical industries of the city are large; the census for 1914 reported over 400 establishments, with a combined invested capital of $19,000,000 and a gross production of nearly $17,000,000. Among these, silk and lace mills, axle-works, foundries and machine shops and wire-rope works are the most important. The city also contains breweries, manufactories of cotton goods and the Lehigh Valley Railroad shops. There are three national banks and six savings banks and trust companies working under State charters. The city is well built and has a public square containing four acres and a park ("The River Common") containing 35 acres along the river front. In the vicinity of the city are the Wyoming Monument, already mentioned, the old Forty Fort Church, Harvey's Lake (the largest lake in Pennsylvania) and other points of historic interest. The notable public buildings are the city hall, courthouse, jail, post office, armory and Memorial Hall. The city has a number of charitable institutions, including two hospitals — one the City Hospital and the other Mercy Hospital (under the management of the Roman Catholics); a Home for Friendless Children and a Home for Homeless Women. It has 20 public school buildings, including the

high school building erected in 1890, in which, in addition to the usual studies, instruction in manual training is given. It has also six Roman Catholic parish schools and is the seat of Harry Hillman Academy (for boys), the Wilkes-Barre Institute (for girls), the Wilkes-Barre Business College, the New Century School of Correspondence and two Roman Catholic academies for girls — Saint Mary's, connected with Saint Mary's Convent, and Saint Ann's, connected with Mallinckrodt Convent. There are two large public libraries — The Osterhout Free Library (having reference and circulating departments), and the reference library of the Wyoming Historical and Geological Society. In addition, the Law and Library Association, the Young Men's Christian Association and other organizations have library collections. The government of the city is of commission form, the mayor being elected for four years and the four councilmen for two years; the appointing power rests with the mayor and commission. Pop. 75,000. But, elbowing the city on all its boundaries are boroughs and hamlets, so that within a radius of nine miles from the centre of Wilkes-Barre there is a population of approximately 200,000.

WILKIE, wil'ki, **Sir David**, Scottish painter: b Cults, Fifeshire, 18 Nov. 1785; d. at sea, off Gibraltar, 1 June 1841. In 1799 he entered the Trustees' Academy, Edinburgh, where he studied for several years. In 1804 he returned home and painted 'Pitlessie Fair,' the first of that class of works for which he became famous. In 1805 he went to London, taking with him the 'Village Recruit,' which at length found a purchaser for £6. The Earl of Mansfield purchased his 'Village Politicians,' which at the Royal Academy (1806) excited universal admiration. It was succeeded by the 'Blind Fiddler' and among the works painted between this period and 1821 may be mentioned the 'Rent Day' (1807); 'Blindman's Buff' (1813); 'Distraining for Rent' (1814); 'The Penny Wedding' (1818); the 'Reading of the Will' (1820); and the 'Chelsea Pensioners,' begun in 1817 and finished in 1821, for the Duke of Wellington. Among the most noted of his later pictures are the 'Entrance of George IV into Holyrood'; the 'Spanish Council of War'; and the 'Maid of Saragossa.' In 1836 William IV created him a knight. In 1840 he made a journey to the East and on the way home was attacked by fever at Malta and died at sea.

WILKINS, wil'kinz, **Mary Eleanor**. See FREEMAN, MARY ELEANOR WILKINS.

WILKINSBURG, wil'kinz-berg, Pa., borough, Allegheny County, on the Pennsylvania Railroad, seven miles east of Pittsburgh. It was formerly called McNairville and Rippeyville and was given its present name in honor of William Wilkins, Secretary of War in 1843–45; it was incorporated as a borough in 1887. Its business interests are identified with those of Pittsburgh and it is almost entirely a residential town; it contains two banks and two newspapers. It is the seat of a home for aged women (Protestant) and of the United Presbyterian Home for the Aged; and there is a high school, established in 1898. Pop. 25,000.

WILKINSON, wil'kin-son, **Henry Spenser**, English author: b. Manchester, England, 1 May 1853. He was educated at Owens College, Manchester, and at Merton College, Oxford, and in 1880 was called to the bar. He was on the staff of the Manchester *Guardion*, 1883–92, and since 1895 has been on the staff of the London *Morning Post*. His writings include 'Essays Toward the Improvement of the Volunteer Forces' (1886); 'The Brain of an Army' (1890); 'The Great Alternative, a Plea for a National Policy' (1894); 'The Nation's Awakening' (1896); 'British Policy in South Africa' (1899); 'War and Policy' (1900); 'The Nation's Need, Chapters on Education' (edited, 1903), etc.

WILKINSON, James, American soldier: b. Benedict, Md., 1757; d. near City of Mexico, 28 Dec. 1825. He studied medicine in Philadelphia and in 1775 enlisted in Washington's army. He became intimate with Benedict Arnold and Aaron Burr, and, having received a captain's commission, joined Arnold's expedition to Canada. He was later appointed to the staff of General Gates, was promoted colonel, and subsequently became deputy adjutant-general of the army of the northern department. In the Saratoga campaign he appropriated as his own the information of the British position and strength which had been secured by Col. John Hardin and after the surrender of Burgoyne was commissioned to bear the news to Congress, carrying with him also the recommendation of Gates that he be appointed brigadier-general. He was 18 days in making the journey and the news was a week old when he delivered his message. Congress refused to grant his promotion at that time, but a few weeks later, through the influence of Gates, he was brevetted brigadier-general and subsequently was appointed secretary of the board of war, of which Gates was also a member. He was deeply implicated in the Conway Cabal (q.v.), which his indiscretion betrayed and was then forced to resign his brevet rank, though retaining his colonelcy. He took no further active share in the war until 1779, when he was appointed clothier-general, an office which he resigned in 1781. He removed to Kentucky in 1784 and in 1786 founded Frankfort. He gained considerable political influence there, intrigued with the Spanish government, with the hope of forming of the Western country a separate republic under the protection of Spain. His reward for this betrayal of his country was to be the exclusive control of commerce on the Mississippi and a yearly pension from the Spanish government. The plot was to be consummated at the convention which met in 1788 for the purpose of forming a constitution for the new State of Kentucky. Wilkinson's influence, however, proved insufficient, and the plot, becoming known to other leaders, fell through. The part of Wilkinson remained a secret, and though he continued to receive his pension from the Spanish government until 1800, he applied in 1791 for service in the army. His treasonable act not being known, he was appointed lieutenant-colonel, served in the Indian wars of the West and was prominent in Anthony Wayne's campaign. He was promoted brigadier-general in 1792, and in 1796 succeeded Wayne in the command of the army. After the acquisition of Louisiana he was appointed in 1805 governor of the Territory of Louisiana and in this position engaged with Aaron Burr (q.v.) in the latter's scheme for founding an empire in Mexico.

In 1806 Wilkinson, perceiving an opportunity to drive a double bargain, betrayed the scheme to the President, and at the same time demanded from the viceroy of Mexico a reward for saving that kingdom to Spain. The assertions of Burr as to Wilkinson's complicity in the plot were generally believed, but at that time no proof of his guilt was obtainable, though he barely escaped indictment on the same charge with Burr in 1807. Inquiry concerning his pension from the Spanish government was made in that year upon a resolution of John Randolph, but he was exonerated. Charges were again made against him in 1810 on the score of complicity with Burr and of receiving pay from the Spanish government, but he was finally acquitted in December 1811, and resumed command in the army. He was promoted major-general during the War of 1812, and commanded the Canada Expedition, but proved incompetent and in 1814 was superseded. He was court-martialed in that year on several serious charges — neglect of duty, conduct unbecoming an officer, drunkenness, etc.— but in 1815 was acquitted and honorably discharged from the army. He then removed to the City of Mexico, where he spent the remainder of his life. He published 'The Aaron Burr Conspiracy Exposed' (1808); and 'Memoirs of My Own Times' (1816). Consult Clark, 'Proofs of the Corruption of Gen. James Wilkinson' (1809); Gayarré, 'Spanish Dominion in Louisiana' (1854); Gilmore, 'Advance-Guard of Western Civilization' (1887); Roosevelt, 'Winning of the West,' Vol. III (1894); Green, 'The Spanish Conspiracy' (1891); McCaleb, 'The Aaron Burr Conspiracy' (1903); and 'Later Intrigues of Wilkinson with the Spaniards' (in 'Amer. Hist. Review,' Vol. XIX, New York 1914).

WILKINSON, Jemima, American religious visionary: b. Cumberland, R. I., 1753; d. Jerusalem, Yates County, N. Y., 1 July 1819. She was educated as a Quaker and at 20, after a severe attack of fever, professed that she had been raised from the dead, that her carnal life was ended and that henceforth her body was reanimated by the spirit and power of Christ. She pretended to work miracles, and, though entirely illiterate, induced many intelligent people to become her followers, her attractive person and extraordinary tact and shrewdness aiding her in maintaining the imposture. In 1786, at a meeting of her disciples, it was resolved to found a colony in Yates County, N. Y., in the present town of Torrey. The next year 25 of her followers went to the new purchase and prepared the land for wheat. In 1789 two of the number purchased 14,000 acres of land in that vicinity, to which was afterward added the township of Jerusalem. The same year Jemima and a large number of her followers came, and a house was erected for her. She had taken the name of the "universal friend," and assumed a costume which belonged about equally to either sex, as she asserted that in her spiritual body there was no sex. She was accompanied by two "witnesses," Sarah Richards and Rachael Miller. She exacted from her followers the most complete submission and the most menial services, her influence over them being practically supreme. A farm of 1,000 acres was set apart for her special use and cultivated freely by her followers. She insisted on the Shaker doctrine of celibacy, and the exercises at her religious meetings resembled those of that sect. She never relinquished her pretensions, but after some years her influence waned, and the latter part of her life was embittered by jealousies and annoyances which she bore with no great fortitude. After her death the sect was entirely broken up. Consult Hudson, 'Jemima Wilkinson, a Preacheress of the 18th Century' (1821); 'Memoir of Jemima Wilkinson' (Bath, N. Y., 1844).

WILKINSON, Sir John Gardner, English archæologist: b. Haxendale, Westmoreland, 5 Oct. 1797; d. Llandovery, Caermarthenshire, 29 Oct. 1875. He was educated at Harrow and Oxford, and after leaving Oxford lived in Egypt 1821–33, during his stay making a thorough study of the ancient monuments of that country as well as of the languages and manners of the modern inhabitants. The most important fruit of his labors was a work entitled 'Manners and Customs of the Ancient Egyptians Derived from a Comparison of the Painting, Sculpture, and Monuments Still Existing, with the Accounts of Ancient Authors' (1837–41), which still remains a standard authority on all that relates to Egyptian art. His later works about Egypt are of a more popular character. Among them are 'Modern Egypt and Thebes' (1833), afterward abridged and published as a 'Handbook for Travelers in Modern Egypt' (1847); 'A Popular Account of the Ancient Egyptians' (1853), and 'The Egyptians under the Pharaohs' (1851), forming a supplement to the previous work. His principal other works are 'Dalmatia and Montenegro' (1848), and 'Color, and the Necessity of a General Diffusion of Taste Among All Classes' (1858). He was knighted in 1839. The collections made by him were given in part to the British Museum, but a considerable proportion of them was presented to Harrow.

WILKINSON, William Cleaver, American educator: b. Westford, Vt., 19 Oct. 1833. He was graduated from the University of Rochester in 1857, was ordained in the Baptist ministry in 1859 and in 1859–61 was pastor of the Second Baptist Church, New Haven, Conn. He was professor *ad interim* of modern languages at the University of Rochester in 1863–64, and was engaged in pastoral work at Cincinnati, 1863–66. He was professor of homiletics and pastoral theology at the Rochester Theological Seminary in 1872–81, was engaged in literary work in 1873–92 and has since been professor of poetry and criticism at the University of Chicago. He was counsellor of the Chautauqua Literary and Scientific Circle and has published 'The Dance of Modern Society' (1868); 'A Free Lance in the Field of Life and Letters' (1874); 'The Baptist Principle' (1881); 'Poems' (1883); 'Edwin Arnold as Poetizer and Paganizer' (1885); 'Classic German Course in English' (1887); 'The Epic of Saul' (1891); 'The Epic of Paul' (1898); 'The Epic of Moses' (1903); 'Daniel Webster: a Vindication' (1911); 'Paul and the Revolt Against Him' (1914).

WILKINSONIANS. See Religious Sects.

WILL. It has been usual to classify mental phenomena under the three headings of cognition, feeling and will or conation. In the last class are included all those processes in which the mind is regarded as effecting some change in its own states, or in the physical environment by means of bodily movements. These changes may take place in a more or less conscious way: that is, in producing changes by means of inner or outer acts of will, we may be more or less explicitly aware of the nature of the result to be attained and of other possible lines of action. It is an essential characteristic of the states that we name impulses or instincts that they are not deliberative. These processes, however, as expressions of the appetitive or active powers of the mind, are conative in character. Automatic or reflex acts, on the other hand, being brought about without any mediation of consciousness, cannot be regarded as belonging to will at all. In impulse the act is initiated by a feeling of uneasiness or craving which has a tendency to discharge immediately in some movement to relieve this feeling. It is from such immediate and impulsive reactions of consciousness that those more explicit and conscious processes that we call voluntary acts develop. We are not born with the power of performing voluntary acts, but this is a progressive acquirement that presupposes an experience of the results of involuntary acts, and the means of obtaining or avoiding these results. The development of will, in the true sense in which it is an endowment that belongs only to rational beings, as it passes from the stage of impulse and instinct, involves a growing consciousness of the relative value of various ends, and also of the means that may be used for the realization of these ends. The development of will is thus only possible through the development of the mind as a whole. Moreover, it is to be noted that this development implies further the systematic integration and union of the rational and emotional sides of mind with its active or conative aspect. As mind develops, all of its functions become more closely and organically connected.

What has just been said may serve to show the fallacy in the view of the older psychology which regarded will as a distinct faculty, opposed, as if it were a separate department, to feeling and cognition. It was too often forgotten in making this division that these faculties were not each *sui generis*, and that the so-called "faculty" is only an abstraction if thought of as a kind of entity apart from the concrete processes of consciousness. Moreover, the emotional and cognitive states of mind do not exist in separation from the conative aspect, but the latter is necessarily implicated and involved in them. It has been one of the most important achievements of recent psychological analysis to exhibit the presence of will in various intellectual processes, like perception, association and thinking, in the form of the selective activity of attention. The true view then is that cognition, feeling and conation are "moments" or "aspects" of mind that can be distinguished by analysis, but which exist and function concretely only in relation to each other. At the present time, psychologists are not agreed as to whether it is possible to discover by analysis any definite conative process as a structural element in conscious life, corresponding to the elementary sensations or feelings. The reality and functional efficiency of the will is not really at stake in this question, however, as has been too hastily assumed by certain representatives of both parties to the dispute. Even if it is found that the processes of will cannot be isolated as separate and distinct states of mind, there will be no ground for denying the real activity of the subject. The truth seems to be that will cannot properly be represented in the form of one particular kind of mental content, just because it is the expression of the attitude of the self toward all mental content.

We have seen that those processes of fully explicit will that we term voluntary acts are always accompanied by a somewhat clear consciousness of the end to be realized and of the relation of means to this end. Moreover, in a fully deliberative act of will, there is also a recognition of various competing possibilities and a conscious selection of one to the exclusion of the others. Instead of allowing an impulse to pass at once into action in accordance with the immediate demands of some single want or uneasiness, in voluntary states consciousness takes control, looking before and after and comparing the consequences of different lines of action. In many cases its efficiency and control are shown by checking or inhibiting the immediate impulse by the thought of some more valuable end with which it conflicts.

How are such volitions to be described psychologically? What actually goes on when a decision is voluntarily made? If we leave out of account the various sensations of muscular strain that accompany volitions, we may say that the essence of the act consists in fixing one alternative and holding it fast before us by means of selective attention. This attention is not passively determined by the greater intensity or immediate attractiveness of one object, but is the result of the fullest activity of the subject, and is at once a psychological fact and a moving force in the external world. As Professor James remarks: "We do not first have a sensation or thought, and then have to add something to it to get a movement. Movement is the natural immediate effect of feeling, irrespective of what the quality of the feeling may be. It is so in reflex action, it is so in emotional expression, it is so in voluntary life."

The Freedom of the Will.—The vexed problem of the freedom of the will arises from the fact that there seems to be an antagonism between the demands of our intellect and those of our moral nature. On the one hand, there is the requirement that all phenomena of the inner life, like those of external nature, shall be capable of explanation according to the law of cause and effect. On the other hand, it is maintained that if morality is to have any meaning, the individual must be free and thus responsible for his acts. In favor of determinism, it is argued that the mental life is composed of a series of states or processes that are related to each other causally just as are events in the external world; this is the necessary assumption of psychology and of all the sciences that attempt to explain the mental life. "Whenever determination by necessary laws ceases, there ceases also the possibility of any explanation." Moreover, determinists point out

ing it, or by making a new will, which later document invalidates all preceding wills. The destruction of a later will revives a former will if still in existence, which will then have full effect. In some States the subsequent marriage of the testator invalidates a will. The laws of the different States vary as to the provisions for the heirs and next of kin.

A will may be written in any form of language that expresses the intention of the testator. A very common form of beginning a will is: 'In the name of God, amen. I, John Smith, being of sound mind,' etc. It need not be written in any prescribed form, but must show the intention. It may be written in any sort of writing material or on several pieces of paper if their sense shows them to be connected each to the other. Separate documents may be included in the will if the will speaks of their incorporation in the will as a part of it, and in such a way as to identify the documents. Publication is the act of making known in the presence of witnesses that the instrument executed is the will of the testator. It is not necessary for the witnesses to know the contents of the will, but the fact that it is a will. Publication is not necessary in all States. A will usually names one or more persons who shall carry out the will of the testator. This person is known as the executor or executrix. When no person is named in the will the court appoints such person, who is known as the administrator or administratrix. At the death of the testator the will is placed on file for probate in the Probate or Surrogate Court. A will is construed liberally, the words taken in their plain and usual sense, and the intention of the testator allowed to prevail wherever possible to understand such intention. Effect is given to every part of a will. Rules of construction are valuable only in case the will is contested. Favor is shown in case of contest to natural heirs and next of kin. Conditions may be made, and trust estates created, and whatever interest the testator may have at death may be disposed of by will during his lifetime to take effect at death. When a testator has a large estate it is customary to have his will drawn up by an attorney who is familiar with rules of construction and of evidence. This is not necessary to the validity of a will, which may be written by any one so long as it is properly signed and witnessed.

WILL-O'-THE-WISP. See IGNIS FATUUS.

WILLAMETTE, wil-ā'mĕt, a river in Oregon which has its rise in Lane County, flows nearly north and enters the Columbia River in Columbia County, in the northwestern part of the State. The total length is about 225 miles. It was originally navigable only for large steamers to Portland (q.v.), 15 miles from its mouth, but the canal around the Willamette Falls permits river traffic 100 miles or more.

WILLAMETTE UNIVERSITY, a co-educational institution of higher learning at Salem, Ore. It was founded as an Indian mission school in 1834 and became a school for white children in 1844; while it was established as the present university in 1853. Its school of medicine was organized in 1867 and that of law in 1884. Its other courses include liberal arts, theology, art and music. It confers the degrees A.B., A.M., B.D., M.D., D.D. and LL.D. In 1918 it had 283 students enrolled, 46 with the colors, and there were 16 instructors. The grounds and buildings are valued at $350,000, while the endowment is about $575,000.

WILLARD, Archibald M., American painter and illustrator, son of a Baptist clergyman: b. Bedford, Ohio, 1836; d. Cleveland, Ohio, 11 Oct. 1918. The family settled later at Wellington, where the boy developed a marked interest in sketching, but opportunity for training in artistic lines being wanting, he worked for some years at decorative painting and continued his efforts in sketches and portraits. At the outbreak of the Civil War he enlisted with the 88th Ohio regiment and served as color-bearer. After the war he made battle sketches but at length found his forte in sketches showing humor and intensity of action and emotion. His better known subjects are 'Pluck'; 'The Nursery'; 'The Drummer's Last Yarn'; 'Deacon Jones's Experience'; and 'Pitching the Tune.' His more serious work includes 'Minute Men of the Revolution' and 'Spirit of '76.' The last named was originally entitled 'Yankee Doodle,' and was produced for Centennial year. The models used were Hugh Mosher, a local fifer, and his father, and Harry, son of Gen. J. W. Devereux, as the drummers. The picture was received with popular enthusiasm and exhibited at the Philadelphia Centennial and the larger cities of the United States. It was finally purchased and presented by General Devereux to his native town, Marblehead, Mass., where it hangs in Abbott Hall. The artist lived for some years in New York but passed his earlier and later years in Cleveland.

WILLARD, Ashton Rollins, American art critic: b. Montpelier, Vt., 14 April 1858. He was graduated from Dartmouth in 1879, removed to Boston in 1887 and has since spent much time in Europe. In 1902 was made chevalier of the Order of the Crown of Italy. His writings include 'Life and Work of Painter Domenico Morelli' (1895); 'History of Modern Italian Art' (1898); 'Land of the Latins' (1902).

WILLARD, Edward S., English actor: b. Brighton, Sussex, 1853; d. 9 Nov. 1915. His first appearance on the stage was made at Weymouth in 1869, but his London début was not made until 1881. He became manager of the Shaftesbury Theatre in 1889 and in 1890 came to the United States, where he played successfully for three years. He leased the Comedy and Garrick Theatres in London in 1894 and later made several tours of the United States, playing various leading parts under his own management.

WILLARD, Emma Hart, American educator: b. Berlin, Conn., 23 Feb. 1787; d. Troy, N. Y., 15 April 1870. She began her career as a teacher in 1803, subsequently became principal of a girls' academy at Middlebury, Vt., and in 1809 was married to Dr. John Willard. She opened at her home in Middlebury, Vt., in 1814, a boarding school for girls in which she introduced various improvements in methods of instruction and also taught subjects hitherto [illegible] included in the curriculum of girls'

Desiring a broader field for the development of her ideas of education she addressed to the New York legislature in 1819 a treatise entitled 'A Plan for Improving Female Education.' It was an able exposition of excellent ideas and found favor with Gov. John Clinton, resulting in the establishment in that year of a seminary for girls at Waterford, N. Y., which was incorporated and was partially supported by the State. She removed to Troy in 1823, where she was presented by the city with a suitable building for her school, henceforth known as the Troy Female Seminary. After the death of her husband in 1825 she conducted the business management of the school in addition to her other work until 1838, when she resigned her duties into the hands of her son. She traveled in Europe in 1830, assisted in founding a school for girls in Athens, Greece, and afterward published 'Journal and Letters from France and Great Britain' (1833), the proceeds of which she presented to the school. She was married to Dr. Christopher C. Yates in 1838, but in 1843 she secured a divorce from him and resumed her former name. She traveled 8,000 miles through the Southern States in 1846 engaged in lecturing before conventions of teachers, and in 1854 was present at the World's Educational Convention in London. Mrs. Willard is one of the most prominent figures in the history for higher education for women in the United States. She was not only an advocate of advancement but a practical worker for it, and brought to her task great earnestness of purpose, coupled with high abilities and executive capacity. Her school-books were widely used and were translated into European and Asiatic languages. They include 'The Woodbridge and Willard Geographies and Atlases' (1823); 'History of the United States' (1828); 'Treatise on the Circulation of the Blood' (1846); 'Last Leaves of American History' (1849); 'Astronomy' (1853); 'Morals for the Young' (1857), etc. She also wrote some excellent verse, which includes the famous 'Rocked in the Cradle of the Deep.' A statue was unveiled to her memory at Troy in 1895. Consult Lord, John, 'Life of Emma Willard' (1874).

WILLARD, Frances Elizabeth, American educator and temperance reformer: b. Churchville, N. Y., 28 Sept. 1839; d. New York, 18 Feb. 1898. She was graduated from the Northwestern Female College, Evanston, Ill., in 1859, engaged in teaching, was appointed professor of esthetics in the Northwestern University in 1869, and became dean of the Women's College of that institution in 1871. In 1874 she resigned this position, was elected secretary of the Woman's Christian Temperance Union in that year, and in 1879 she became its president, an office she held until her death. In her management of the association she displayed great executive ability and a remarkable genius for organization. She founded in 1883 the World's Christian Temperance Union, and in 1888 became its president. She declared herself in favor of woman's suffrage in 1876, and thereafter lectured occasionally upon the subject, deeming the ballot a protection to women from the miseries caused by drink. In 1892 she visited England, where she was the guest of Lady Henry Somerset, the temperance reformer, and while there addressed a mass meeting at Exeter Hall, said to have been one of the largest assemblages ever held there. She devoted her life to a cause, and won the admiration and love of a vast number of people, even those who did not agree with many of her views. In all the long list of reformers who have sought to rid the world of the evils of the liquor traffic there is no name that stands higher than that of Frances E. Willard. In her work Miss Willard displayed an untiring energy, and for 10 years she averaged a meeting a day, meanwhile continuing her literary labors. She was editor of the Chicago *Post and Mail* for a short time after 1878, and from 1892–98 editor-in-chief of the *Union Signal*, the official organ of the temperance movement. Her publications include 'Nineteen Beautiful Years' (1868); 'Woman and Temperance' (1883); 'Glimpses of Fifty Years' (1889); 'A Great Mother' (1894), etc. She also edited with Mary A. Livermore, 'A Woman of the Century' (1893).

WILLARD, Joseph, American clergyman and university president, great-grandson of Samuel Willard (q.v.): b Biddeford, Me, 9 Jan. 1738; d. New Bedford, Mass., 25 Sept. 1804. He was graduated at Harvard University in 1765 and was a tutor there in 1766–72. In 1772 he was ordained in the Congregationalist ministry and became joint pastor of the First Congregationalist Church at Beverly, Mass. From 1781 until his death he was president of Harvard University. His publications include a number of sermons and some papers on astronomy and mathematics. He left an unpublished Greek grammar.

WILLARD, Joseph Edward, American Ambassador: b. Washington, D. C., 1 May 1865. He was graduated at the Virginia Military Institute in 1886 and later took a summer course in law at the University of Virginia. He served as a captain of United States volunteers in the Spanish-American War. He was a member of the Virginia legislature in 1894–1902; was lieutenant-governor of Virginia in 1902–06; and was State Corporation Commissioner in 1906–10. He was appointed United States Minister to Spain by President Wilson in 1913, and his rank was raised to Ambassador 13 Sept. 1913.

WILLARD, Josiah Flynt, American author and sociologist: b. Appleton, Wis., 23 Jan. 1869; d. Chicago, Ill., 20 Jan. 1907. While studying at the University of Berlin in 1890–95 he became interested in sociological problems, and was impressed with the danger impending to the United States through its being a haven of refuge for European criminals when their own country would no longer suffer their being at liberty. In order thoroughly to understand the situation and the actual conditions and feelings governing the tramp world he led for several years the life of a vagrant, publishing the results of his observations in 'Tramping with Tramps' (1899). His other writings include 'Powers that Prey' with F. Walton (1900); 'Notes of an Itinerant Policeman' (1900); 'The World of Graft' (1901); 'The Little Brother' (1902); 'The Rise of Roderick Clowd' (1903).

WILLARD, Samuel, American clergyman, scholar and educator: b. Concord, Mass., 31 Jan. 1640; d. Boston, Mass., 12 Sept. 1707. Graduated from Harvard in 1659, he studied theology, and in 1663 was ordained minister at Groton, Mass. This village having been destroyed by the Indians (1676) during King Philip's War, he removed to Boston, where he was made colleague of Thomas Thacher, pastor of Old South, and upon the latter's death (15 Oct. 1678) succeeded to the pastorate, which he held until his death. In 1700 he became vice-president of Harvard, and in 1701, upon the resignation of President Increase Mather (q.v.) (6 Sept.), assumed the direction of the institution. He retained the active pastorate of the South Church, however, and by order of the General Court was debarred from the title of president. He was opposed to the persecutions for witchcraft, and wrote and spoke against the delusion. In 1688 he began to give a series of Tuesday afternoon lectures on theology, and these he continued for the rest of his life. The lectures were printed in 1726 in a folio of 914 double columned pages. "The thought and expression of this literary mammoth," says Tyler, "are lucid, firm, and close." Willard published numerous sermons and other writings.

WILLARD SCHOOL, The Emma. The Emma Willard School, which in 1914 entered on its second century of usefulness, is one of the oldest institutions for the higher education of women in the United States. It is the outgrowth of an institution founded by Emma Willard (q.v.) in Middlebury, Vt., in 1814. In 1819, the patrons of Waterford, N. Y., urged removal of the school to that place, believing the richer State of New York would grant it an appropriation. The legislature did not grant an endowment, but the application led to the allowing of a portion of the literature fund for girls' schools, to be given to the school, the first legislative appropriation of money for the education of girls. In 1821, Mrs. Willard accepted an invitation from the citizens of Troy to remove the seminary to that city, where the school became known as the Troy Female Seminary. From the establishment of the seminary in Troy in 1821, to 1875, more than 15,000 pupils were connected with the school. In 1892, a complete reorganization of the course of study was made, the art department was introduced, the boarding department was opened in Russell Sage Hall, and the old name gave way to that of Emma Willard School, thus bringing the school into close touch with its famous past and associating it in name with its illustrious founder. The school is situated in Troy, N. Y., on the Hudson River, in a healthful climate.

WILLCOX, Cornélis DeWitt, American army officer and educator: b. Geneva, Switzerland, 26 Feb. 1861. He came to the United States, was graduated at the University of Georgia in 1880, at the United States Military Academy in 1885, at the Artillery School in 1892, and in 1913 studied at the University of Grenoble. He was a captain of volunteers in the Spanish-American War, and in 1908–10 he was chief of the military information division at Manilla, P. I. He was appointed professor of modern languages with rank of lieutenant-colonel at the United States Military Academy in 1910 and was promoted colonel in 1914. He was one of the founders of the *Journal of the United States Artillery* in 1892; and from 1915 was editor of the *International Military Digest*. In 1917–18 he was with the American Expeditionary Force in France. Besides translating several works from the Spanish he is author of 'A French-English Military Technical Dictionary' (1900; new ed., 1910); 'The Head Hunters of Northern Luzon' (1912); 'A Reader of Scientific and Technical Spanish' (1913); 'Spanish Official Account of the Attack on the Colony of Georgia' (1913); 'War French' (1917).

WILLCOX, Orlando Bolivar, American soldier: b. Detroit, Mich., 16 April 1823; d. Cobourg, Ontario, Canada, 10 May 1907. He was graduated from West Point in 1847, served in the Mexican War and later in the Seminole War and other Indian campaigns. He was promoted lieutenant in 1850 and in 1857 resigned from the army, thereafter engaging in law practice at Detroit until the outbreak of the Civil War, when he re-entered the army as colonel of volunteers. He was engaged at the capture of Alexandria, and at the first battle of Bull Run was wounded and taken prisoner. He was exchanged in 1862 and afterward participated in the battles at South Mountain, Antietam and Fredericksburg, led a division at the battle of the Wilderness and in the Richmond campaign, and in 1864 was brevetted major-general of volunteers. He was the first to enter Petersburg, receiving its surrender, and in 1866 was mustered out of service. He re-entered the regular army with rank as colonel in 1866, was brevetted brigadier-general and major-general in the regular army in 1867 for services at Petersburg and Spottsylvania, and was voted a Congressional medal of honor for gallantry at Bull Run in 1861. He received full rank as brigadier-general in 1886 and in the following year was retired. He wrote 'Shoepac Recollections by Walter March' (1856); and 'Faca: An Army Memoir, by Major March' (1857).

WILLCOX, Walter Francis, American statistician: b. Reading, Mass., 22 March 1861. He was graduated at Amherst College in 1884, at the Columbia Law School in 1887, later studied at the universities of Yale and Berlin and received the degree of Ph.D. at Columbia University in 1891. He was appointed professor of statistics and economics at Cornell University in 1901 and served also as dean of the faculty of arts and sciences in 1902–07. He was one of the five chief statisticians of the 12th United States Census in 1900–1901; was president of the American Statistical Association in 1911–12 and of the American Economic Association in 1915. His works include 'The Divorce Problem: A Study in Statistics' (1891; 2d ed., 1897); 'Supplementary Analysis and Derivative Tables, Twelfth Census' (1906). He has also contributed to periodicals and encyclopedias.

WILLCOX, William Russell, American lawyer and public official: b. Smyrna, N. Y., 11 April 1863. He studied at the University of Rochester and was graduated at the Columbia

Law School in 1889. He engaged in law practice in New York in 1890; served as president of the New York park board in 1902–03; and was postmaster of New York in 1905–07. He was chairman of the New York Public Service Commission in the first district in 1907–15, and in 1916 was appointed chairman of the Republican National Committee.

WILLEMITE, an important ore of zinc and a mineral of much mineralogical interest. It is essentially a zinc orthosilicate, Zn_2SiO_4, but all of the many varieties from Franklin Furnace and Ogdensburg, N. J., its two most prolific localities, contain considerable manganese. The colors of the New Jersey willemite are very varied, white, green, yellow, flesh-red, brown and gray, the last three being characteristic of the variety troostite which occurs in crystals up to six inches in length. The crystallization of willemite is rhombohedral, the common form being a hexagonal prism, either stout or much elongated, terminated by obtuse rhombohedrons. It occurs in small crystals of prismatic or obtuse rhombohedral habit in New Mexico. A granular form is also found in New Jersey in large quantities, intimately mixed with franklinite. Crystals from Belgium have an easy basal cleavage, but this cleavage is difficult in New Jersey crystals, which have eminent prismatic cleavage. The mineral has a hardness of 5.5 and a specific gravity of 3.9 to 4.2. Transparent crystals and masses have been found in New Jersey which yield gems whose beauty is much enhanced by the strong double refraction of the mineral, though the inferior hardness precludes their use as jewels. Ordinarily willemite is opaque, but with transparent portions scattered through the mass. The green phosphorescence of willemite when struck with a hammer has been known for many years. During exposure to the Röntgen rays and to the ultra-violet and other rays of the Piffard lamp a gorgeous green fluorescence is observed in the New Jersey mineral and some specimens are also highly phosphorescent, but these properties are not possessed by willemite from other localities. Radium salts excite instant luminescence in the New Jersey mineral. These observations have attracted widespread interest.

WILLEMS, vĭl'lĕmz, **Florent,** Belgian artist: b. Liége, Belgium, 9 Jan. 1823; d. Neuilly, France, 22 Oct. 1905. He studied at the Academy of Mechlin and formed his style upon that of the old Dutch masters. He removed to Paris in 1844 and was awarded first-class medals in 1855, 1867 and 1878. His work has been well received in the United States and examples of it are included in many private collections. Especially good canvases by him may be seen at the Metropolitan Museum of Art in New York, and at the Art Institute of Chicago.

WILLEMS, Jan Frans, Flemish philologist: b. Bouchout, near Antwerp, Belgium, 11 March 1793; d. Ghent, 14 June 1846. In 1809 he was placed in the office of an Antwerp notary, and in 1811 won a prize for the best poem on the battle of Friedland and peace of Tilsit (1811). His ode, 'Aen de Belgen' ('To the Belgians,' 1818), hailing the revival of Belgian nationality under Holland's protection, brought him a position under the Dutch government and a series of masterly philological works, including 'Over de Nederduitsche Taal en Letterkunde' (1819–20), procured him admission to the Academy of Antwerp. On the formal separation of Belgium from Holland in 1830 he was removed from office and settling at Encloo, he labored there on the Flemish version of "Reynard the Fox," in his edition of it (1834) calling on Flemings to help to preserve their ancient tongue. As archivist of Ghent from 1835 he edited the 'Rymkronyk van Fan van Helu' (1836), 'Brabantsche Yeesten' (1839–43), etc., and after his death appeared his collection of old Flemish songs, and his 'Mengelingen van Vaderlandschen Inhond.' Consult 'Lives' by Snellaert (1847); Rooses (1874); and Rooses, Buylstede, and Bergmann, 'Jan Frans Willems' (1893).

WILLET, a large American snipe of the genus *Symphæmia;* sometimes called pill-willett. The bill is thick, compressed, straight, longer than the head; wings long, legs long and strong; tail short and nearly even. The *S. semipalmata* is about 15 inches long and 31 in alar extent, the bill 2½; it is darkly speckled above; rump, upper tail coverts, and under parts white; tail ashy white, the two middle feathers spotted; secondaries white, with brownish black spots. The young are spotted and transversely banded with brownish black. It is found throughout eastern temperate North America, and in South America, rarely going far from shore; on the Pacific it is represented by a distinct subspecies. It goes South in winter as far as the Gulf States where it also breeds sparingly; and is often found in company with the godwits. It breeds in both fresh and salt marshes on the ground and remains in separate flocks during the fall and winter. The eggs and the flesh, especially of the young birds, are excellent eating. The food consists of small crustaceans, and aquatic worms and insects. They are rather shy, rapid and strong fliers, and good swimmers if necessary, though they cannot dive. They are noisy while breeding, the shrill cry being reiterated as long as an intruder remains in sight. The name is derived from the resemblance of their notes to the "will-willet." Owing to their shyness, the keen sight which enables them to detect the sham of decoys, and their swift, often elevated flight they are difficult to shoot, and offer fine sport to the skilful sportsman. For these reasons, and because of their large size and excellent table qualities they are much sought. Consult Eliot, 'North American Shorebirds' (New York 1895).

WILLETT, Marinus, American soldier: b. Jamaica, N. Y., 31 July 1740; d. New York, 22 Aug. 1830. He served in the French War with rank as lieutenant, was especially prominent in the expedition against Ticonderoga in 1758, and in the capture of Fort Frontenac. He was active in the movements of the Sons of Liberty and on 6 June 1775 took measures to prevent the forwarding of arms from New York to the British troops in Boston Harbor. He served as captain under Montgomery in his expedition against Canada in 1775, remaining in command of the post at Saint John's until January 1776; was second in command at Fort Stanwix in

1777, led and held the fort until relieved by Arnold. In June 1794 he accepted a mission to the Creek Indians present at Monmouth, and in 1779 joined the expedition of General Sullivan against the Six Nations. He commanded the forces in the Mohawk Valley from 1780 until the close of the war, conducting in 1783 the attempted surprise of the garrison at Oswego, which was the last hostile movement against the British. In 1784–92 he was sheriff of New York, and in 1794 accepted a mission to the Creek Indians and succeeded in concluding with them a treaty of peace. He was appointed mayor of New York to succeed De Witt Clinton in 1807, and in 1812 was secretary of a mass meeting which favored military preparations against the British. He left several manuscript journals from which his son, W. M. Willett, prepared 'A Narrative of the Military Actions of Col. Marinus Willet' (1831).

WILLETTS POINT, N. Y., national military reservation on the south shore of East River at its entrance to Long Island Sound. The reservation comprises 136 acres, purchased partially in 1857 and partially in 1863; the construction of a fort was begun here in 1862, but the work was suspended and the fort remains unfinished. After the war an engineer battalion was ordered here to establish a depot for stores, a station for torpedo experiments, and a school of practice. The post which constitutes one of the defenses of New York Harbor is also known as Fort Totten (q.v.).

WILLEY, Waitman T., American statesman: b. Monongalia County, Va. (now W. Va.), 18 Oct. 1811; d. Morgantown, W. Va., 3 May 1900. In 1828, at the age of 17, he entered Madison College (now Allegheny College), Pennsylvania, from which he graduated in June 1831. In 1832 he began the study of law with the distinguished Philip Doddridge at Wellsburg, Va., and in September 1833 was admitted to the bar. Thereafter he resided at Morgantown. He was clerk of both county and circuit courts of Monongalia County from 1841 to 1852. For a quarter of a century before the Civil War, he and George W. Summers of Kanawha County were universally regarded as the Whig wheel-horses of western Virginia. He was a member of the constitutional convention of Virginia, 1850–51. He was the Whig candidate for Congress in 1852, but was defeated, and was also the Whig candidate for lieutenant-governor of Virginia in 1859 but was again defeated. In 1860 he was a delegate to the constitutional union convention which nominated Bell for President. In 1861 he was a member of the Virginia convention in which he voted against the ordinance of secession. In the same year he was elected by the legislature of the "Restored government of Virginia at Wheeling" to a seat in the United States Senate, in place of James M. Mason who had resigned after the secession of Virginia. He was a member of the Wheeling constitutional convention which framed the first constitution of West Virginia, and in 1863 he was chosen to represent the new State in the Senate. In 1864 he was re-elected to the Senate for a term of six years which expired 4 March 1871. In 1871 he served as a member of the second constitutional convention of West Virginia which met at Charleston and framed the present constitution of the State. In 1876 he was a delegate at large to the National Republican Convention which met at Cincinnati.

WILLIAM (Friedrich Wilhelm Viktor August Ernst), ex-crown prince of Prussia and of the German Empire, eldest son of William II, ex-German emperor, and of ex-Empress Auguste Victoria: b. Potsdam, 6 May 1882. In 1905 he was married to Cecilie Auguste Marie, daughter of the Grand Duke Frederich Franz III, of Mecklenburg-Schwerin, of which union several sons were born. He was closely allied with the militaristic group in Germany and was often at variance with his father. He was bitterly criticized for his attitude toward the Zabern incident of 1913. He was also in disfavor with his father because of his book, 'Aus meinem Jagdtagebuch' (1912). At the outbreak of the European War, however, all differences between the emperor and the crown prince appeared forgotten. He commanded the army employed in the operations against Verdun and apparently every effort possible was exerted in the attempt to give him the prestige of victory. At the close of the war he fled to Holland where he was interned at Wieringen, an island in the Zuider Zee. Consult Liman, Paul, 'Der Kronprinz' (Minden 1914), and Gardiner, A. G., 'The War Lords' (New York 1915). See WAR, EUROPEAN — MILITARY OPERATIONS ON THE WESTERN FRONT.

WILLIAM I, surnamed the CONQUEROR, king of England and Duke of Normandy: b. Falaise, Normandy, 1027 or 1028; d. Rouen, 9 Sept. 1087. He was the natural son of Robert, Duke of Normandy, by Arletta, the daughter of a tanner of Falaise, and his father, having no legitimate son, when about to set out on a pilgrimage to Jerusalem, nominated him as his heir. Robert died in 1035, while returning from Palestine; and Normandy fell for a time into a condition of anarchy. When William succeeded to the dukedom his vigor and ability soon restored order, and his power increased so much as to excite the jealousy not only of the surrounding nobles, but of his suzerain the king of France. Two combinations were formed against him, and twice his territory was invaded; but he repelled these aggressions, and reduced the French king to the necessity of peace. The opportunity of gaining a wider dominion presented itself on the death of his second cousin, Edward the Confessor, king of England. When this event took place he laid claim to the English Crown, alleging that Edward had bequeathed it to him. To enforce his claim he invaded England, and the victory of Senlac or Hastings, in which his rival Harold was killed, ensured his success (1066). On the following Christmas Day, William was crowned, after tumultuary election on the part of the English nobles, and took the customary coronation oath. His first measures were mild: he sought to ingratiate himself with his new subjects, preserved his army in strict discipline, confirmed the liberties of London and other cities, and administered justice impartially. On his return to Normandy, however, the English, being treated by the Norman leaders like a conquered people, revolted, and a conspiracy was planned for the massacre of all the Normans in the country. On this intelligence William returned, and began with a show of justice by

repressing the encroachment of his followers; but on reviving the Danegelt, which had been abolished by Edward the Confessor, the discontents were renewed. These he repressed with his usual vigor, and a temporary calm succeeded. The resistance of two powerful Saxon nobles, Edwin and Morcar, who had formed an alliance with the kings of Scotland and Denmark, and with the prince of North Wales, soon after drew William to the north, where he obliged Malcolm, king of Scotland, to do homage for Cumberland. From this time he treated the English like a conquered people, multiplied confiscations in every quarter, and forced the native nobility to desert the country in great numbers. In 1069 another formidable insurrection broke out in the north, and at the same time the English resumed arms in the eastern and southern counties. William first opposed the storm in the north, and executed such merciless vengeance in his progress that the whole country between York and Durham was turned into a desert; and above 100,000 of both sexes and all ages are said to have perished. There being now scarcely a landed proprietor who had not incurred the forfeiture of rebellion, he put into execution his plan of introducing a total alteration of the state of English law and property, by dividing all the lands into baronies and adopting the feudal system in regard to land tenure and services. He also reduced the ecclesiastical property to a similar system, and, to prevent resistance from the clergy, expelled most of the English church dignitaries, and placed Normans or other foreigners in their stead, Lanfranc being made archbishop. Still further to humble the English, he caused French to be used in the courts of justice and in law proceedings, and ordered it to form a leading part of instruction in all the schools throughout the realm. In 1076 he received a demand from Pope Gregory VII, requiring him to do homage for his kingdom, and to pay the accustomed tribute from England to the Holy See. William denied the homage; nor would he allow the English prelates to attend a general council summoned by Gregory, but consented to the levy of Peter's pence. Toward the end of his reign he instituted that general survey of the landed property of the kingdom, the record of which still exists under the title of 'Domesday Book.' The manner in which he laid waste a large district in Hampshire, where he demolished villages, churches and convents, and expelled the inhabitants for 30 miles round, merely to form the New Forest for hunting, exhibits his indifference to the suffering of his subjects, as well as his love of the chase, which he further protected by a most severe code of game laws. In 1087 he went to war with France, whose king had encouraged a rebellion of Norman nobles, entered the French territory, and committed great ravages, but, by the starting of his horse at Nantes, received an injury which caused his death, at the Abbey of Saint Gervais, near Rouen (1087). He left three sons — Robert, to whom he bequeathed Normandy; William, who inherited England; Henry, who received only his mother's property, and five daughters. William the Conqueror was the most powerful sovereign of his time. He possessed superior talents, both political and martial, and employed them with remarkable vigor and industry. His passions were, however, strong; his ambition severe and merciless; and his love of sway often led him to disregard all restraints of justice and humanity. Consult Lappenberg, 'England under the Anglo-Norman Kings,' translated by Thorpe (1857); Palgrave, 'Normandy and England,' Vol. III (1864); Freeman, 'History of the Norman Conquest of England' (1867-71); Stubbs, 'Constitutional History of England' (1874); Green, 'Conquest of England' (1884); Freeman, 'William the Conqueror' (1888); Round, 'Feudal England' (1895).

WILLIAM II, surnamed RUFUS, from his red face, king of England: b. Normandy, 1056; d. New Forest, Hampshire, 2 Aug. 1100. He was the third son of William I and was sent to England by his father the day before the death of the latter with a recommendation to the barons and bishops that he should be the Conqueror's successor. His wishes were respected and William Rufus was crowned at Westminster 26 Sept. 1087. The division of England and Normandy did not, however, please the great barons, who possessed territories in both; and a conspiracy was formed for effecting the deposition of William in favor of his brother Robert; but the conspiracy was repressed with great vigor; the confederate nobles were forced to withdraw to Normandy, and their English estates were confiscated. It is worthy of notice that in this instance a Norman ruler was supported by his English subjects against his Norman ones. Once firmly seated on his throne, William forgot his promises to the English; and the death of Lanfranc, archbishop of Canterbury, freeing him from an authority which he respected, he extended his rapacity to the church, and seized the temporalities of vacant bishoprics and abbeys, to which he delayed appointing successors. In 1090 he made an incursion into Normandy, to retaliate on his brother Robert; but a reconciliation was effected between them. In 1096 Robert mortgaged his dukedom to William for the sum of 10,000 marks to enable him to fit out an expedition and join the crusaders in the Holy Land. William accordingly took possession of Normandy and Maine, although in the case of the latter he was not allowed to do so without a struggle. William Rufus met his death while hunting in the New Forest. His body was found pierced by an arrow, which is generally believed to have been shot, whether accidentally or purposely cannot be said, by a French gentleman named Walter Tyrrel. Tyrrel immediately galloped to the coast, and embarked for France, where he joined the crusaders. The body was interred without ceremony at Winchester. This event took place when the king was in the 44th year of his age, and 13th of his reign. William Rufus possessed vigor, decision and policy, but was violent, perfidious and rapacious. Consult Freeman, 'Norman Conquest of England,' Vol V (1876), and his 'Reign of William Rufus' (1882).

WILLIAM III, king of England and hereditary stadtholder of Holland: b. The Hague, 4 Nov. 1650; d. Kensington, England, 8 March 1702. He was the son of William II of Nassau, prince of Orange, and his mother was Henrietta Mary Stuart, daughter of Charles I of Eng-

land. Educated by the grand pensionary, John De Witt, he gained the love of the people, who in 1672, when Louis XIV invaded the republic, appointed him at once captain-general, grand-admiral and stadtholder of the United Provinces, after enforcing the abrogation of a resolution which De Witt had got passed in 1667, and which declared that in future no captain-general should at the same time be stadtholder. William's management of the war against France was masterly. In the campaign of 1673 he opened the sluices in the dikes around Amsterdam, inundating the whole of the neighboring district and forcing the French to retire. He was able to keep the enemy in check, and by his policy engaged the empire, Spain and Brandenburg to take part with Holland, so that at the Peace of Nijmegen in 1678 the integrity of Holland was respected. William's whole policy was directed against Louis XIV, for whom he entertained a personal hatred, and to curb the ambition of the French monarch he instituted the league of Augsburg, July 1686, between the emperor, Spain, Sweden and Holland, to which Denmark and some German princes also acceded. His wife, Mary, whom he had married in 1677, was the daughter of James II of England, and presumptive heiress to the throne. Unexpectedly James' second wife gave birth to a son, 10 June 1688, and the greater part of the Parliament and of the nation now feared that the bigoted James would introduce Roman Catholicism as the state religion and subvert the constitution. Rumor also asserted that the prince was supposititious. The Episcopalians and Presbyterians in England, under these circumstances, united, in order, by the aid of Holland, to give Mary the succession to the throne. William foreseeing that England, by the policy of his father-in-law, would become more and more closely connected with France, joined with the great majority of the British nation; and the pensionary Fagel persuaded the States-General to support him with ships and troops for the preservation of British freedom and the Protestant religion. William arrived suddenly at Torbay, 5 Nov. 1688, with a fleet of 500 sail, ostensibly equipped against France, and with 14,000 troops. Upon his landing a great part of the nobility immediately declared for him; and James' soldiers by degrees went over to him. In December the king fled with his family to France, after which William made his entry into London. The two houses of Parliament in convention now declared that James II had broken the fundamental compact between the king and the people, and by withdrawing from the kingdom had abdicated the government. On 13 Feb. 1689 Mary was proclaimed queen, and William, her husband, who had meanwhile gone over to the English Church, was proclaimed king. At the same time the declaration or bill of rights settled the limits of the royal power and the order of succession. Scotland followed England's example; but in Ireland, whither Louis XIV sent James with an army, the majority of the Roman Catholics maintained the cause of the deposed king. But William's victories over the army of James on the Boyne, 1 July 1690, and at Aughrim, 13 July 1691, assisted by the clemency with which he treated the vanquished party, made him master of Ireland. In the war on the Continent he was less successful. At Steinkirk he was defeated by Marshal Luxembourg in 1692 and at Neerwinden by the same general in 1693; but always succeeded in wresting from the French the fruits of their victories by skilful retreats and marches. Louis was finally compelled to acknowledge him as king of England at the Peace of Ryswick in 1697. The Parliament insisted at that time on the disbanding of nearly the whole army, deeming a standing army incompatible with the security of the constitution. Soon after, the will of Charles II of Spain, who had made the grandson of Louis XIV his heir, induced William to arm all Europe against Louis in the great alliance of The Hague 7 Sept. 1701. But in the midst of these projects he broke his collar-bone by a fall from his horse between Kensington and Hampton Court, 21 Feb. 1702, and died in consequence of the accident. His wife, Mary, had already died childless in 1694. William's manners were too cold and ungracious to allow him to be popular with the English people. Under a reserved exterior he concealed a strong love of renown and power, and to obtain the majority of votes in Parliament made use of bribery. Immersed in politics and war, he had neither leisure nor inclination for literature and art. In conversation he was grave and unattractive; but in business, penetrating, quick and decided; in danger, undaunted; in difficulties, unshaken; in war, bold without ostentation. Consult Burnet, 'History of His Own Times'; Trevor, 'Life and Times of William III' (1835); Macaulay, 'History of England'; Hallam, 'Constitutional History'; Ranke, 'History of England' (1875); Traill, 'William III' (1888); Hippold, 'William III, Prince von Oranien, Erbstatthalter von Holland, König von England' (1900); Lodge, R., 'History of England' (1910).

WILLIAM IV, king of Great Britain and Ireland, third son of George III: b. 21 Aug. 1765; d. Windsor, 20 June 1837. From 1779 to 1790 he served in the navy, and after quitting active service was raised successively to all the higher grades of naval command, becoming in 1801 admiral of the fleet. In 1789 he was raised to the peerage with the title of Duke of Clarence. He frequently spoke in the House of Lords, and held the office of lord high-admiral (1827–28). He became heir presumptive to the throne in 1827 and succeeded his brother George IV as king 26 June 1830. On his accession he retained the ministers then in office with assurances of his confidence in their zeal and ability. In the new Parliament, which met in November, the ministry, being left in a minority on a motion of Sir H. Parnell for referring the civil list to a select committee, immediately sent in their resignation; and a Whig administration was formed with Earl Grey at its head. The great events which render his reign memorable are the passage of the reform act, the abolition of slavery in the colonies and the reform of the poor laws. William IV married in July 1818 Adelaide, sister of the Duke of Saxe-Meiningen, by whom he had no surviving children. He had, however, a large family by Mrs. Jordan, the celebrated actress, who was for many years his mistress, while Duke of Clarence. Her liaison with the duke lasted from about 1790 till 1811, when an arrangement was

made by which she and her family were provided for. William IV was succeeded by his niece Victoria. Consult Fitzgerald, 'Life and Times of William IV' (1884); Walpole, 'History of England from the Conclusion of the Great War in 1815' (1878–86); Malloy, J. F., 'The Sailor King, William IV' (1903).

WILLIAM I, or **WILHELM I**, emperor of Germany and 7th king of Prussia: b. Berlin, 22 March 1797; d. there, 9 March 1888. He was the second son of Frederick William III and Louisa of Mecklenburg-Strelitz, and from his earliest years was trained in military exercises. In the campaign of 1813–14 he joined the Prussian forces as captain, receiving then, for his bravery in the field, the "Cross of Saint George" from the Tsar Alexander. On the death of his father in 1840 he became heir presumptive to the throne, and received the title of Prince of Prussia. On the outbreak of the revolution in 1848 he left Berlin for England, but was soon recalled and in the following year proceeded against the insurgents with military vigor and suppressed the insurrection in Baden and the Palatinate. His brother having become incapable of ruling William (1857) was appointed regent, and in January 1861 became king, being crowned at Königsberg in October of the same year. With the assistance of Otto von Bismarck (q.v.) as president of the Cabinet and Von Roon as War Minister, he demanded from the nation a large scheme of army reform, and his foresight in this matter was justified by the Prussian success in the war with Denmark (1864) and the complete overthrow of Austria at Sadowa (1866). The latter war had been brought about by the diplomacy of Bismarck, who now proceeded to form a North-German Confederation with King William as its head, and to conclude a treaty of alliance, offensive and defensive, with the South German States. This growing power of Prussia provoked the jealousy of France, and a crisis was reached in the negotiations concerning the Spanish crown. War was proclaimed between Prussia and France (1870), and the South-German States having declared in favor of the former, King William led the combined German forces through the campaign, which resulted in the defeat of Napoleon at Sedan, and finally in the siege and capitulation of Paris. Meanwhile the North-German Parliament, uniting with the German princes, desired the king to become German emperor. This honor he accepted, and he was crowned as Emperor William I at Versailles on 18 Jan. 1871. After the conclusion of peace with France, and having entered Paris with his army, the emperor returned to Berlin amid great enthusiasm. The latter part of his reign was passed in consolidating the power of the new German empire, and in parliamentary and political conflicts with the Catholic, Liberal and Socialist parties in the state. (See GERMANY). His life was attempted several times. Among biographies are those of Forbes (1888); Smith, G. B., (1887); Strauss (1887); Simon (French, 1887, Eng. trans.); Marcks, 'Kaiser Wilhelm I' (1899). Consult also Von Sybel, 'Die Begründung des Deutschen Reichs' (1889–94; Eng. trans. 1890–92); Malleson, 'Refounding of the German Empire' (1892); Krause, 'Growth of German Unity' (1892); Oncken, 'Das Zeitalter des Kaisers Wilhelm' (1890–92); Blume, 'Kaiser Wilhelm' (Berlin 1906); Delbruech, F., 'Die Jugend William I' (Berlin 1907).

WILLIAM II (Friedrich Wilhelm Victor Albert), ex-German emperor and king of Prussia, commonly called Kaiser Wilhelm, son of Frederick III and Victoria, Princess Royal of Great Britain, and grandson of William I: b. Berlin, 27 Jan. 1859. At birth he suffered an injury of the left arm which would have disqualified a private person for the army, but nevertheless he received a thorough military education. In 1869 he was enrolled in the army as second lieutenant, in 1874 entered the gymnasium at Cassel, and three years later, as first lieutenant, was admitted to the University of Bonn, where he remained until 1879, his principal studies being political science and law. He married (27 Feb. 1881) Princess Victoria of Schleswig-Holstein-Sonderburg-Augustenburg, and they had issue: six sons and a daughter.

In 1880 William entered the army to which he devoted himself with all earnestness, and in 1885 became colonel of the Hussars of the Guard. In spite of his physical defect he was soon one of the most capable and dashing officers in the army. He also displayed talents in literature and art, which he has pursued in various directions. Strengthened by physical culture and the diversions of hunting and other sports in which he excelled, he came to the throne (15 June 1888) well trained in mind, inured to exacting labors and filled with self-reliance and enthusiasm. Statecraft he had learned in the school of Bismarck (q.v.), and his political and personal ideals were imbued with veneration for his grandfather, whose conviction of "divine right" he embodied in his own view of the imperial office. His personal aggressiveness and military methods gave rise to popular fear of indiscretions whereby he might endanger the peace of Germany and of the world, but he vigorously repelled those suspicions of his motives which led to his designation as the "War-lord." Quite early in his reign Gladstone expressed a fear of what might happen through the young kaiser's indiscretions, but the warning was largely unheeded. During the mortal illness of his father when crown prince, William was called upon to repudiate a charge of conspiracy to keep him from the throne; his own behavior in the three months of his father's reign betrayed no want of filial devotion. Upon his father's death his attitude toward his mother was the subject of much criticism, but on his accession William at once asserted his ideas of personal rulership, which he maintained in theory, and in practice relaxed only in submission to demands of policy. After he had been on the throne two or three years, there were 1,800 Germans in confinement for *lèse majesté*, many of whom had been guilty of most trifling indiscretions in speaking of the young kaiser. This created scandal, and William became aware that it was a bad policy and the law was relaxed. The kaiser soon actively concerned himself with every department of German life, and his personal sway was qualified only by the limitations of the constitution and of public opinion. By travel, in which he visited all the principal capitals of Europe, he familiarized himself with inter-

national affairs and became an expert in world-politics. When Moltke died the emperor declared that he had "lost an army," but when he quarreled with Bismarck he showed no misgivings at the loss of the masterful chancellor and reputed creator of the empire, whose retirement he virtually compelled in March 1890. By this act, cleverly characterized by his critics as "dropping the pilot," he made himself more distinctly master of the ship of state. He had evidently begun to have confidence in his own powers and judgment. His able chancellors — Caprivi, Hohenlohe, Bulow — were compliant to the imperial will. Shortly before Bismarck's death the emperor sought reconciliation, and their friendship was partially restored. In some things, notably in maintaining the Triple Alliance, the emperor followed the policy of Bismarck. William measured his strength against all liberalizing parties, and his early solicitude for the laboring classes latterly seemed lost in his bitter antagonism to socialistic elements. Bismarck's *kulturkampf* legacy William sagaciously disposed of through concessions which he turned to profit by making an implicit alliance of the Vatican and the German schools in his anti-revolutionary policies and by remodeling the schools themselves.

With all his alleged autocratic tendencies William undoubtedly sought the aggrandizement of Germany, her industrial and commercial supremacy, colonial expansion and primacy among the great powers. He extended the imperial influence to Turkey and Asia Minor, and strengthened German interests in the Far East and in Africa and South America. He held the press to a strict account; the army and navy, which he would make superior to all others, he kept in strong control. For many years his attitude indicated no menace, rather a promise of protection to the cause of peace, which on more than one occasion he doubtless aided in preserving. Herein his conduct was less aggressive than many of the speeches in which he addressed himself through Germany to the world. The sending of his brother, Prince Henry of Prussia, to the United States, in 1902, did much to promote friendly sentiment and to cover up the unpleasantness aroused in America over the suspicious conduct of the German naval vessels at Manila Bay when Admiral Dewey opened the battle there with the forces of Spain in May 1898.

Notwithstanding William's general good conduct, his occasional outbursts of ambition, and his persistence in building up the army and navy, constantly aroused suspicions of his intentions. From 1895 to 1908 he was continually at war with the Reichstag over the development of naval power. He kept demanding and he got larger and larger appropriations for battleships. He developed the Heligoland stronghold and the Kiel Canal, and managed things so that the Baltic was virtually a German lake. He backed and encouraged Zeppelin in the development of his great unwieldy aircraft, designed to maintain supremacy in the air. The apprehension developed by all these things in the British isles was so marked that 28 Oct. 1908 William permitted an interview to be printed in the London *Telegraph*, in which he explicitly stated that he held the friendliest feelings toward England and that his naval policy was intended for the protection of German interests in the Far East. This did not particularly reassure the British and it did create a stir among Eastern diplomats, especially in Japan, China and Russia, as well as among Germans at home.

With all his wonderful abilities for organization and domination William had a streak of indiscretion in many of his public utterances, and was frequently expressive of ideas appropriate to sovereigns of the Middle Ages. He was a firm believer in the divine right of kings and of kaisers in particular. On numerous occasions he spoke of himself as "the instrument of the Lord," and took such excessive interest in the army, so often spoke of his confidence in it, and permitted and even fostered such arrogance in his offices, that the whole world came to recognize that the army ruled Germany and the kaiser ruled the army. The important men were the generals, and the business interests too often centered around the Krupp works.

From other viewpoints William was much admired. He had a keen interest in industrial development, and understood and appreciated the wonders of modern mechanism. He was a musician of no mean ability and fond of the theatre. He had energy plus, and gave more thought to the details of Germany's progress than had any other ruler. Had his ambition stopped here, he had gone down to history as one of the world's most efficient sovereigns, who though ruling with a rod of iron, sought mainly the progress of the country as a whole. But his selfish ambition had no bounds. It is now generally conceded that almost from the first day of his reign he began to plan for world domination; that he dreamed of what Napoleon might have done had he been a little more shrewd and painstaking, and resolved that he, William, would show the world that one man could raise himself to the topmost pinnacle and not only rule Germany, but through Germany might rule the civilized earth.

His effort to attain his ends by means of the cruel World War made him the most hated man on the globe. His intentions were laid bare, and he stood in naked repulsiveness the embodiment of mad and selfish ambition that cared not what seas of blood flowed so long as "I am lord of all." It is difficult for this generation to judge calmly of the character of the world's greatest criminal, as he appears to our eyes in 1920, an exile and outcast in Holland, awaiting judgment and condemnation. Only the historians of the future can sift his character and determine with some degree of accuracy the elements that ruled him. Was he so obsessed with the idea of becoming the world's ruler that he became irresponsible in his personal conduct and dead to all sense of suffering inflicted on millions of his own people and the people of other lands? Or was he always callous to the feeling of humanity and sympathy, rather enjoying, like Nero, the sufferings of his victims?

The principal details of William's career are given elsewhere in the articles on GERMANY and the EUROPEAN WAR, to which the reader is referred. For his earlier career consult

Bigelow, 'The German Emperor' (1889); Frederic, 'The Young Emperor, William II' (1891); Meister, 'Kaiser Wilhelm II' (1894); Lowe, 'The German Emperor, William II' (1896); 'The Kaiser's Speeches' (1903); Topham, Anne, 'Memoirs of the Kaiser's Court' (New York 1914); Gauss, 'The German Emperor: His Public Utterances' (1915).

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WILLIAM I, prince of Orange, count of Nassau, surnamed the SILENT: b. Castle of Dillenburg, Nassau, 16 April 1533; d. Delft, Holland, 10 July 1584. He was the eldest son of William, count of Nassau, and Juliana, countess of Stolberg, and was educated in the Roman Catholic faith by Maria, queen of Hungary, sister of Charles V. He spent nine years in attendance on the person of the emperor, who had so high an esteem for his spirit, prudence and intelligence that he asked his opinion respecting the most important matters, and when he was but 22 entrusted him with the chief command of the army in the Netherlands, in the absence of Philibert, duke of Savoy. He also recommended him to his successor, Philip II, who regarded him with distrust. As Cardinal Granvella had now the entire confidence of Philip, and Margaret of Parma, who was, charged with the government of the Netherlands, was obliged to do whatever Granvella suggested, especially with respect to the introduction of the Spanish inquisition, and the erection of new bishoprics, the Count of Egmont, the Prince of Orange and the Count of Horn represented to the king in writing, that unless the cardinal were speedily recalled his violence would drive the country to rebellion. Though Philip looked on this step as treason, he concealed his anger, and recalled the cardinal (1564). After the remonstrance offered in 1566 by 300 noblemen (the Gueux), with Count Louis of Nassau, the brother of William, at their head, against the introduction of the Inquisition and the establishment of new bishoprics, had been rejected and the Duke of Alva had been appointed governor of the Netherlands, William had a meeting with Egmont, Horn, his brother Louis and others at Dendermond, to deliberate on the means of averting the threatening danger. The majority advised an armed resistance, but this proposal came to nothing on account of the opposition of the Count of Egmont. The prince with his family now went to his castle at Dillenburg. Alva arrived in the Netherlands in 1567 and many men of consequence, including Egmont and Horn, were immediately arrested. In the beginning of 1568 he caused the prince and others, who had retired from the country, to be summoned before the Council of Twelve. The prince did not appear, in consequence of which Alva declared him an outlaw, confiscated his property and removed his son Philip William, from the University of Louvain, and sent him as a hostage to Spain. The Prince of Orange now determined on waging war against Alva. In a document issued in the summer of 1568, and called his "justification," he gave the reasons for his conduct and publicly professed the Protestant religion. In consequence of this he received aid in money and troops from several Protestant princes. William now raised an army of 24,000 Germans, who were joined by 4,000 French soldiers, conducted his forces with great skill across the Rhine and Meuse, entered Brabant and defeated a division of the hostile army but was unable to bring the Duke of Alva, who threw himself into the fortresses, to an engagement, or to excite the people, who feared the Spaniards, to a general insurrection. His army now dispersed. He then took part in an expedition to France against the Catholic party of the Guises (1569). In France Admiral Coligny had advised him to fit out privateers against the Spanish, and establish himself particularly in Zealand and Holland, from which the Spaniards would hardly be able to drive him. The prince followed this advice, and the privateers made themselves masters, in 1572, of the town and harbor of Briel, on the island of Voorn and also took Flushing. As Alva's tyranny became more intolerable and the people were exasperated by new exactions, several cities of Holland, Zealand, Overijssel and Gelderland publicly declared for the Prince of Orange. Relying on the assistance of France, which Admiral Coligny had promised to obtain for him, William crossed the Rhine, but the news of the massacre of Saint Bartholomew deprived him for the time of all hope of French aid. He then retired into the province of Holland, which steadfastly supported him. He now resumed negotiations with France and obtained a treaty in which France promised to support him, provided that it should receive the protectorate over all the provinces of the Netherlands, which he succeeded in wresting from the Spaniards. At the end of 1573 Alva was recalled and replaced by Requesens. In 1574 Louis and Henry of Nassau, William's brothers, made an effort to join him, but were totally defeated by Requesens at Mookerheide, near Nijmegen. Both of William's brothers fell on the field of battle. This blow was compensated by the relief of Leyden, at that time hard pressed by the enemy. The raising of the siege of Leyden saved the province of Holland for the time, but the Spanish were still formidable, and Holland might have been completely crushed had it not been for the death of Requesens, which took place in March 1576. After this event William succeeded in bringing about the so-called pacification of Ghent (8 Nov. 1576), in which nearly all the provinces of the Low Countries united to expel the foreign troops, and promised mutual toleration in matters of religion. The new stadtholder, John of Austria, sought to break the force of the union by granting, in the perpetual edict, almost all the demands of the people (1577), but his conduct soon manifested his insincerity and the states of Antwerp then called the Prince of Orange to their aid. The people received him with acclamations in Brussels, and he was appointed to the rank of lieutenant-general. The war was now renewed and by the victory at Gembloux in the end of January 1578 the Spaniards recovered their superiority in the Walloon provinces, which were zealously Catholic. In 1579 Don John of Austria died, and the king appointed Alexander Farnese of Parma as his successor. The policy of Farnese

succeeded in gaining over to the king the southern provinces and the prince, therefore, brought the five northern provinces, Holland, Zealand, Utrecht, Gelderland and Friesland, into closer connection by the union of Utrecht, 23 Jan. 1579 and thus laid the foundation of the republic of the United Netherlands. In 1580 the king, finding it impossible to triumph over William by fair means, put a price upon his head. This step induced the united provinces to renounce their allegiance to Philip, and William was offered the dignity of sovereign count of Holland and Zealand, which he accepted. But the edict of Philip proclaiming a reward for his life was not without effect. In 1582 an attempt was made by a Spaniard named Jaureguy to assassinate him at Antwerp, and a second attempt made at Delft on 10 July 1584, by a Burgundian fanatic, Balthasar Gerard, succeeded. William of Nassau was four times married. Maurice of Nassau, who distinguished himself as a general in the Thirty Years' War, was one of his sons and William III of England, a grandson. Consult Gachard, 'Correspondance de Guillaume le Taciturne' (1847-66); Motley, 'The Rise of the Dutch Republic' (1856); Klose, 'William I von Oranien' (1864); Juste, 'Guillaume le Taciturne d'après sa Correspondance et ses Papiers d'Etat' (1873); Putnam, 'William the Silent, Founder of the Dutch Republic' (1895); Frederic Harrison 'William the Silent' (1897); and 'Cambridge Modern History' (Vol. III).

WILLIAM I, Frederick, king of the Netherlands, grand duke of Luxemburg, prince of Orange and duke of Nassau: b. The Hague, 24 Aug. 1772; d. Berlin, 12 Dec. 1843. He was the eldest son of William V, Prince of Orange-Nassau, and was married to Frederike Luise Wilhelmine, daughter of Frederick William II of Prussia in 1791. He distinguished himself in the wars with the French republic, and became an exile with his father, the hereditary stadtholder of the Dutch republic, in 1795, and for several years lived at Fulda. After his father's death, in 1806, he succeeded to the duchy of Nassau and joining the Prussian army against Napoleon was captured at Jena and his possessions confiscated. Released soon afterward he fought against the French at Wagram. At the Congress of Vienna the kingdom of the Netherlands was formed composed of Holland and Belgium and 16 March 1815 William I was proclaimed king. His hereditary estates having been given to Prussia and Nassau, he received in exchange the grand duchy of Luxemburg. Belgium was, however, separated from Holland by the revolution of 1830, and as William was unwilling to recognize its existence as an independent state, he became unpopular. He continued to protest up to 1839, and the next year abdicated in favor of his son, retiring to Berlin at the same time with an immense fortune.

WILLIAM II, Frederick George Louis, king of the Netherlands: b. The Hague, 2 Dec. 1792; d. 17 March 1849. He was the eldest son of the preceding monarch; distinguished himself in the Peninsular War under Lord Wellington, and also commanded the army of the Netherlands at the battle of Waterloo. In 1816 he was married to the grand duchess Anna Paulovna, sister of Alexander I of Russia. His reign began at his father's abdication in 1840, but although he brought order out of the financial chaos caused by his father, he was by nature opposed to political reform. In 1848 events obliged him to consent to an entire reorganization of the government, but his death took place before the new constitution could go into effect.

WILLIAM III, Alexander Paul Frederick, king of the Netherlands: b. The Hague, 19 Feb. 1817; d. Loo, 23 Nov. 1890. He was the eldest son of the preceding emperor and his reign was chiefly distinguished by undertakings for internal improvement. Under his rule, the kingdom enjoyed uninterrupted peace and material prosperity. He carried out the parliamentary reforms instituted in 1848 and in 1862 decreed the abolition of slavery in the Dutch West Indies. In 1866 the Dutch province of Limburg, a member of the Germanic Confederation from 1815, was restored to the Netherlands and by the treaty of 11 May 1867, the grand duchy of Luxemburg was declared neutral territory under the sovereignty of the house of Orange-Nassau. While Prince of Orange, he married in 1839, the Princess Sophia Frederica Matilda, daughter of the late King William I, of Würtemberg. They had two sons, William Nicholas Alexander Frederick Charles Henry, Prince of Orange (b. 4 Sept. 1840; d. 11 June 1879), and William Alexander Charles Henry Frederick (b. 25 Aug. 1851; d. 21 June 1884), the last male heir of the house of Orange. In 1879 King William was married to Emma, Princess of Waldeck-Pyrmont, their daughter Wilhelmina becoming heir to the throne.

WILLIAM I, surnamed THE LION, king of Scotland: b. 1143; d. Stirling, 1214. He was a grandson of David I and brother of Malcolm IV, whom he succeeded in 1165. The source of his designation is one of the mysteries of history. His predecessors had long contested with the kings of England the sovereignty of Northumberland and other districts of the north of England, but under Malcolm these claims were virtually abandoned and the king of Scots received, as an equivalent for them, the earldom of Huntingdon and other valuable estates. William still coveted the Northumbrian region and while attending Henry II of England in his wars upon the Continent, is supposed to have asked for a portion of the disputed territory. On being refused he invaded the district after the example of his ancestors, but on 13 July 1174 fell into the hands of the English. For security he was conveyed to Normandy, and there consented, as the price of his liberation, to perform that homage for his kingdom which the English kings so long vainly required from the government of Scotland. The treaty of Falaise, as the arrangement was termed, from the place of its adjustment, was revoked in 1189 by Richard I of England in consideration of a payment of 10,000 marks, needed for his expedition to Palestine. William had several disputes with the Church, but was one of the early benefactors of the regular ecclesiastics,

and founded in 1178 the great abbey of Arbroath, which he dedicated to Saint Thomas a Becket.

WILLIAM IX, Duke of Aquitaine and Count of Poiton, the first great Provençal poet: b. 1071; d. 1127. He appears to have led a very licentious life, which is constantly reflected in his poems. His poetical work is of special interest as it stands at the beginning of the Classical period in Provençal literature, and marks the transition from the popular minstrel ballads to the more Classical and arbitrary literature of the courts of the several Provençal principalities. Much of the work of William of Aquitaine is very close to the popular poetry that he must have found existing in the south of France when he began to write. One of his poems—a romance of licentious adventure, probably quite in the style of the approved poetry of his time—shows special signs of being close, not only to the popular ballad, but bears imprinted upon it the stamp of the loose manners and customs of the age in which it was written. In his poetry there is already developed the stereotyped poem describing the devotion of the knight to his lady. So assured is this form even at this early day, in the mouth of one who, on his own confession, was true to no lady, that it would seem as if it must have already existed long enough to have acquired a set form and character. But the disappearance of practically all the Provençal poetry of the time preceding the practical activity of William of Aquitaine, has obliterated the record of the past upon which he undoubtedly builded. William of Aquitaine led a very active life, most of which was taken up with wars against the neighboring rulers. He led a plundering expedition into Normandy and conquered Toulouse. But his greatest exploit was the crusade of the year 1100, on which he started out for Palestine with an army of 60,000. He reached Jerusalem, but was finally defeated and forced to flee with a handful of followers. On the way back he was shipwrecked; so that it was over three years before he reached home. Notwithstanding this religious expedition William quarreled with the Church, defied the papal authority and was twice excommunicated. A poem written toward the close of his life, however, expresses repentance for his sins and his ecclesiastical attitude and repentance. In it he vows the renunciation of all worldly pleasures and the dedication of himself to the service of God. It seems probable, in view of what is known of his life, that his execution was not equal to the facility of his poetical expression. Consult Holland and Kellar for an incomplete edition of his works (1850); Sachse, 'Über das Leben und die Lieder des Troubadours Wilhelm IX Graf von Poitou' (Leipzig 1882).

WILLIAM OF LORRIS, French poet: b. about 1212. His chief fame rests on the 'Romance of the Rose' of which he wrote the first 4,000 verses. This is a long allegorical poem written in 1237, but left unfinished by the author who is supposed to have died young. It has been said that the 'Romance of the Rose' is a sort of art of love. At any rate it was the forerunner of a kind of literature which became very popular in France and continued to exercise its influence for a considerable length of time there and in most of the Latin and Germanic countries of Europe. His work is among the best and most original of his age; but the rhetorical figures and allegories which were its most distinguishing feature were seized upon by subsequent writers, imitators of the 'Romance of the Rose,' and the result was a very extensive and popular literature which tended to grow more and more untrue to nature, art and correct literary expression. See 'Romance of the Rose.' Consult Jarry, L., 'Guillaume de Lorris et le testament d'Alphonse de Poitiers' (Orleans 1881); Langlois, E., 'Origines et Sources du Roman de la Rose' (Paris 1891); Paulin, 'Histoire Littéraire de la France' (Paris).

WILLIAM OF MALMSBURY, mämz'-bĕr'ĭ, English historian: b. probably in Somersetshire, about 1070; d. Malmsbury, Wiltshire, about 1143. He was educated at the Benedictine Abbey of Malmsbury of which he subsequently became librarian and precentor, and from which his name is derived. His works are in Latin and are of great historical value. They include 'De Gestis Regum Anglorum,' a general history of the kings of England from 449 to 1128; 'Historia Novella,' containing the narration to 1142; 'De Gestis Pontificum Anglorum,' an ecclesiastical history of England down to 1123; 'Vita S. Dunstani'; 'Vita S. Wulfstani,' etc. The best edition of his English and Church histories is that of Stubbs in the Rolls Series (1887–88). Consult Birch, 'Life and Writings of William of Malmsbury' (1874); Stubbs' Prefaces in the Rolls Series; Norgate, 'England Under the Angevin Kings,' Vol I (1887).

WILLIAM OF NEWBURGH, English chronicler: b. Bridlington, Yorkshire, about 1136; d. Newburgh, near Coxwold, Yorkshire, about 1198. He was educated, lived all his life, and died in the Augustinian Abbey of Newburgh. He is one of the chief authorities for the reign of Henry II. His 'Historia Rerum Anglicarum' covers the period from 1066–98, is written in five books, and is highly valuable as a broadminded, just and clear presentation of the happenings of the times, though his statements are not always accurate. His other works consist of three sermons. Consult Howlett in the Rolls Series, 'Chronicles of Stephen, Henry II and Richard I' (1884).

WILLIAM OF NORMANDY (The Clerc), a French poet of the first half of the 13th century. He wrote principally moral poems and religious legends and traditions. There has been much strife among critics as to just what poems of those attributed to him were really written by him. Among his surviving poems about which there does not seem to be any reasonable doubt, are 'Le Bestiaire divin' (edited by Hippeau in 1852; and by Reinsch 1890); 'Le Besant de Dieu' (edited by Hippeau, 1852; by Martin, 1879); 'Les Joies Notre-Dame' (edited by Reinsch, 1879); 'Sainte Madeleine' (edited by Schmidt, 1880); 'Tobie' (edited by Schmidt, 1880), and 'Le Roman des Romans.' Among the poems which have been attributed to him by some critics and editors, a verdict strongly contested by others, are cer-

tain fables and 'Fergus.' Consult Mann, 'Der Bestiaire divin des Guillaume le Clerc' (in 'Französische Studien,' 1889); Schmidt, 'Guillaume le Clerc de Normandie im besondere seine Magdalenenlegende' (in Romanische Studien, 1880); Seeger, 'Ueber die Sprache des Guillaume le Clerc de Normandie' (Halle 1881).

WILLIAM OF TYRE, Syrian historian and archbishop; b. probably in Syria, about 1137; d. about 1184. He was educated at Antioch and Jerusalem, and in 1175 was made archbishop of Tyre. He was one of the six bishops who represented the Latin Church of the East at the Lateran Council in 1179. His 'Historia Rerum in Partibus Transmarines Gestarum' is one of the best histories of mediæval times, and is the principal authority for the history of the Latin kingdom in the East from 1127–84. He also wrote 'Historia de Orientalibus Principibus.'

WILLIAM OF WYKEHAM, wik'ăm, English prelate, architect and statesman: b. Wykeham, Hampshire, 1324; d. South Waltham, Hampshire, 24 Sept. 1404. He received a liberal education from the lord of the manor of Wykeham, and was afterward recommended by him to the notice of Edward III, who made him chief keeper and surveyor of the several of the royal castles. He built Windsor Castle, and afterward, taking orders, held various ecclesiastical posts, becoming bishop of Winchester in 1367. He was lord chancellor of England 1367–71, founded in 1373 a grammar school at Winchester, which still exists as Winchester College, and New College, Oxford, which he completed in 1386. He was lord chancellor for the second time 1389–91 and rebuilt the nave of Winchester Cathedral in the Third Pointed manner 1395–1405. He is buried in a magnificent chantry chapel in the south arcade of the nave at Winchester. Consult 'Three Chancellors' (1860); and 'Lives,' by Lowth (1758), and Moberly (1887).

WILLIAM HENRY, Fort, in the town of Caldwell, N. Y., at the head of Lake George (q.v.). In August 1757, it was taken from the English by a force of French and Indians under Montcalm.

WILLIAM JEWELL COLLEGE, located in Liberty, a suburb of Kansas City, Mo. It was founded in 1849 by the Baptists of Missouri; Dr. William Jewell of Columbia, Mo., was one of the leaders in the movement for the establishment of the college, and contributed $10,000 in lands toward the endowment, hence the college was named for him. It was opened to students in 1850, and on account of financial difficulties was closed in 1855–57; just as the college was becoming prosperous, the Civil War again forced the work to suspend from 1861 to 1868; for a part of that time the building was occupied by the Federal troops. Since 1877 the endowment has been raised to over $200,000. The college offers four courses or groups, leading to the degree of A.B. Some studies are required in all groups, and some are free electives. The curriculum includes several theological courses, completion of which by arrangement with the Southern Baptist Theological Seminary at Louisville, Ky., entitles the student to credit at that seminary. The degree of A.M. is conferred for graduate work. There are also courses in elocution, oratory and music, and an Academic Department. A college band and a college orchestra are maintained. There are 44 scholarships. The student organizations include four literary societies, Philharmonic (a musical society), a Young Men's Christian Association and missionary societies. The buildings include Jewell Hall (the original building), Vardeman Hall, Brown Hall, Wornall Hall, Ely Hall, The Cottages, and the gymnasium. The library contains 29,000 volumes; the students average 350, and the faculty 28, while the productive funds total $513,330.

WILLIAM AND MARY COLLEGE, located at Williamsburg, Va. It was chartered in 1693, thus being the second oldest college in the United States; but an attempt was made to found a college at Henrico in Virginia as early as 1619 when a grant of land for a "seminary of learning" was made by the Virginia Company; a collegiate school was established at Charles City in 1621, but closed on account of Indian troubles in the next year. In 1635 Benjamin Symes established a free school in Elizabeth City County, the first in the 13 colonies. In 1660 the Virginia assembly voted a grant of land for a college, but the disturbed condition of England at that time, and the disorders within the colony, prevented any further progress toward establishing an institution of higher learning until in 1691, when Rev. James Blair was sent to England to obtain a charter from the Crown. In this he was successful, the charter being signed 8 Feb. 1693. Certain lands, a duty on the exports of tobacco, and other funds were appropriated to the use of the college. During the Revolutionary War the college lost a large part of its endowment, the buildings were occupied by the British and the American and French troops, and the institution was closed for a short time in 1781. After the Revolution, the college was reorganized and received a grant of land from the Virginia legislature; George Washington served as chancellor from 1788–99. During the Civil War the college was closed, and about 90 per cent of its students enlisted in the Confederate service. It was occupied by the Federal troops and most of its buildings and property destroyed. In 1869 the main building was restored, and the college again opened, but under serious embarrassment; so serious did the financial difficulties become that its sessions were suspended in 1882, until 1888, when the State legislature appropriated $10,000 a year, gradually increased to $50,000. In 1893 the college received $64,000 from Congress as indemnity for loss suffered during the Civil War.

The college has always given history and political science a recognized place in its curriculum, and was the first American institution to establish chairs of law and history. Partially perhaps for this reason, its influence has always been felt in State and national history; it numbers among its graduates some of the leading men of the nation, including three presidents of the United States (Jefferson, Monroe and Tyler), also Chief Justice Marshall, Edmund Randolph and General Scott. The first chapter of Phi Beta Kappa was established at William and Mary 5 Dec. 1776. The college was also the

first to introduce the elective system which was done in part in 1779 under Jefferson's guidance. In 1819 Jefferson declared in a letter to Francis Eppes that at William and Mary the student could pursue the course of his choice. At this time there appear to have been two classes of students — "regulars and irregulars." The first class took a prescribed course for A.B., the latter followed their own inclinations, and attended the schools of their own selection. The college was also the first to try the honor system, and a remarkable degree of freedom was permitted the students in the lecture room and on examination. They were neither watched nor spied upon, and their word was taken as conclusive on any subject. There are now two courses offered, the Collegiate and the Normal. The Collegiate course is entirely elective in accordance with the group system; three degrees are conferred, A.M. (for graduate work), A.B. and B.S., according to the subjects elected. The Normal course is two years in length, to which is added one year's practice work in the Matthew Whaley Model and Practice School. The most recent new feature at the college is the admission of women to all the classes. The campus consists of 42 acres upon which there are 13 buildings. In the centre is the main college structure. Though it has passed through three fires, the walls are the same as were originally put up in 1693. They are, therefore, the oldest college walls in the United States. The lawn in front of the college is covered with beautiful trees, and the buildings are furnished with electric lights, artesian well water, and new equipment. The college receives annually from the legislature $50,000. The students average 237, and the teaching force 22. Young women were admitted upon equal terms with young men for the first time in September 1918.

WILLIAM PENN CHARTER SCHOOL, a secondary day school for boys, located at Philadelphia. In 1683 the governor and council of the province engaged a schoolmaster (Enoch Flower) for "the instruction of the youth" of Philadelphia; from this grew the Charter School, founded in 1689 and incorporated in 1698 by the council and lieutenant-governor as "the public school founded in Philadelphia at the request, costs and charges of the people of God called Quakers." Although supported by the Quakers, it was open to all, and for more than 60 years continued to be the only public place for instruction in the province. In 1701 Penn was asked to confirm the lieutenant-governor's charter by one under his own hand and seal. This he did on the same day that he chartered the city itself. The school therefore enjoys, in this regard, a unique distinction. The two subsequent charters issued by Penn, one in 1708 and the other in 1711 (the last the legal one under which the board now works) rendered broader and more far-reaching the measures for the school's future development. The school was entirely emancipated from denominational control, and the title of the corporation changed by omitting the words "at the request, costs and charges of the people of God called Quakers," the title in the final charter standing: "The Overseers of the Public School founded by Charter in the Town and County of Philadelphia in Pennsylvania" (the word "public" being used in the English sense, open to all willing to pay the fees). The school premises are now located in the heart of the city and, taken with the beautiful playing fields in the suburbs presented to the school in 1903, are valued at $250,000; and the scholarship funds amount to about $50,000. It is purely a day college preparatory school for boys, and has for years been famed for both its high standard of scholarship and the intelligent care devoted to physical training. The students have long numbered over 500, it being the largest boys' day school of its class in the United States. Its attendance is not confined to residents of Philadelphia.

WILLIAM TELL. See WILHELM TELL.

WILLIAMS, Alpheus Starkey, American soldier: b. Saybrook, Conn., 20 Sept. 1810; d. Washington, D. C., 21 Dec. 1878. Graduated from Yale in 1831, he studied in the law school there in 1831–33, and in 1836 began legal practice in Detroit, Mich. There he held local offices, and in 1840–44 was probate judge of Wayne County. He became proprietor of the *Daily Advertiser* of Detroit in 1843, and remained its editor until 1848. During the Mexican War he was lieutenant-colonel of the First Michigan volunteers. In May 1861 he received the commission of brigadier-general of volunteers. Later he was a division commander in the Shenandoah, and in 1862 became temporary commander of the 12th corps, which he directed until April 1863, leading it at South Mountain and Antietam. He was also in command of a corps at Gettysburg and, after his transfer to Tennessee, at Lookout Mountain. After commanding a division of the 20th corps in Sherman's Atlanta campaign, he was appointed in November to command that corps, and led it in the "March to the Sea" and the campaign in the Carolinas. Upon the capture of Savannah he was brevetted brigadier-general of volunteers. Mustered out in January 1866, he was Minister to San Salvador in 1866–69 and member of Congress in 1875–78. In 1870 he was Democratic candidate for the governorship of Michigan.

WILLIAMS, Anna Bolles, American writer of juvenile tales: b. New London, Conn., 1840. She published, under the nom-de-plume J. A. K., 'Birchwood' (1885); 'The Fitch Club'; 'Professor Johnny' (1887); 'Rolf and His Friends'; 'Who Saved the Ship'; 'The Giant Dwarf'; 'The Riverside Museum'; 'History of the Rogerenes.'

WILLIAMS, Arthur Llewellyn, American Protestant Episcopal bishop: b. Owen Sound, Ontario, 30 Jan. 1856. He received an academic education and engaged in the railroad business in Colorado for several years. He then studied theology and was graduated at the Western Theological Seminary, Chicago, in 1888. Admitted to the diaconate in 1888 and to the priesthood in 1889, he served as missionary in White River Valley, Colo., 1888–89, was rector of Saint Paul's Church, Denver, 1891–92 and of Christ Church, Chicago, 1892–99. In October 1899 he was consecrated bishop-coadjutor of Nebraska.

WILLIAMS, Benjamin, American statesman: b. North Carolina, 1754; d. Moore County,

WILLIAMS, George Henry, American senator, Cabinet officer and jurist: b. New Lebanon, N. Y., 23 March 1823; d. 4 April 1910. He was admitted to the bar in 1844 and removed to Iowa where he engaged in practice. He was judge of the First Judicial Court of Iowa in 1847–52; and in 1853–57 he was chief justice of the Oregon Territory. He was one of the framers of the constitution of the State of Oregon, and served as United States senator for that State in 1865–71. He was Attorney-General under President Grant in 1872–75. His nomination by President Grant for justice of the Supreme Court of the United States was not confirmed by the Senate. After his retirement as Attorney-General he practised law at Portland, Ore., and he was mayor of that city in 1902–05.

WILLIAMS, George Huntington, American geologist: b. Utica, N. Y., 28 Jan. 1856; d. there, 12 July 1894. He was graduated at Amherst College in 1878, later studied at Brunswick and Göttingen and took the degree of Ph.D. at Heidelberg in 1882. He was afterward connected with the faculty of Johns Hopkins University, and was appointed professor of inorganic chemistry there in 1892. He made special investigations of the geology of Maryland and materially assisted the United States Geological Survey of that State. He was editor of the department of mineralogy and petrography of the 'Standard Dictionary' (1893); was author of 72 papers on geology, and of 'Elements of Crystallography' (1890).

WILLIAMS, George Washington, American author: b. Bedford Springs, Pa., 16 Oct. 1849; d. 1891. He was of African descent, served in the Civil War, subsequently attended school and was for a time engaged as a preacher and then as a journalist. In 1877 he was graduated from the Cincinnati Law School and in 1879–81 served in the Ohio legislature. He was United States Minister to Haiti in 1885–86, and in 1888 was a delegate to the World's Conference of Foreign Missions at London. He was editor of the Cincinnati *Southwestern Review* and of the Washington *Commoner*, and published 'History of the Negro Race in America from 1619 to 1880' (1883); 'History of the Negro Troops in the War of the Rebellion' (1887); 'History of the Reconstruction of the Insurgent States' (2 vols., 1889), etc.

WILLIAMS, Gershom Mott, American Protestant Episcopal bishop: b. Fort Hamilton, N. Y., 11 Feb. 1857. He studied at Cornell, 1875–77, was in mercantile business for several years and after studying law was admitted to the Michigan bar in 1879. The next year he was ordained to the Episcopal ministry and held rectorships at Detroit, Buffalo, Milwaukee and Marquette (1880–96). In 1896 he was consecrated bishop of Marquette.

WILLIAMS, Helen Maria, English author: b. London, 1762; d. Paris, 15 Dec. 1827. She was introduced to public notice by Dr. Andrew Kippis, who recommended very highly her first work, a legendary tale in verse, entitled 'Edwin and Eltruda,' which was published in 1782. Between this period and 1788 she published an 'Ode on Peace' (1783); 'Peru, a Poem' (1784); and a collection of miscellaneous poems (1786). In 1790 she settled in Paris, in the same year published a series of 'Letters Written in France,' and in 1792–96 a second series, 'Letters from France,' and in 1795 a third, 'Letters Containing a Sketch of the Politics of France.' These 'Letters' advocated the doctrines of the Girondists, on whose downfall she was in great danger, and for some time imprisoned. They are one-sided and replete with inaccuracies and misrepresentations. Among her remaining works are 'A Tour in Switzerland' (1798); 'Narrative of Events in France' (1815); 'Correspondence of Louis XVI' (1803); 'Letters on the Events Which Have Passed in France since the Restoration in 1815' (1819); an English translation of Humboldt's 'Personal Narrative' (1814); 'Julia,' a novel (1790); and the story, 'Perourou, the Bellows-mender' (1801), on which was based Lord Lytton's 'The Lady of Lyons.' Mention may be made of several well-known hymns by her, such as 'My God, all Nature owns Thy Sway' and 'While Thee I Seek, Protecting Power.'

WILLIAMS, Henry Shaler, American geologist and palæontologist: b. Ithaca, N. Y., 6 March 1847. He was graduated from Yale in 1868, occupied the chair of geology at Cornell in 1879–92, resigning in the last-mentioned year to accept a similar chair at Yale, which he held until 1904, when he returned to Cornell. He was secretary of the International Congress of Geologists at Washington in 1891 and was chairman of the section of geology and geography of the American Association of Advanced Sciences in 1892. He has made extensive studies of the Devonian and Carboniferous systems and has published 'The Classification of the Upper Devonian' (1885); 'Fossil Faunas of the Upper Devonian' (1884–87); 'The Cubaodes Zone and Its Fauna' (1890); 'Correlation Papers, Devonian and Carboniferous' (1891); 'Shifting of Faunas as a Problem of Stratigraphic Geology' (1903); 'On the Theory of Organic Variation' (1911), etc.

WILLIAMS, Isaac, English theologian and author: b. near Aberiptwith, Cardiganshire, 12 Dec. 1802; d. Stinchcombe, Gloucestershire, 1 May 1865. He studied at Trinity College, Oxford, in 1831 became Fellow there and took priest's orders, and was known as one of the leading Tractarians (q.v.). He was Newman's curate at Saint Mary's and was later in charge of the church at Littlemore. With Newman, Froude and Keble he contributed to the *British Magazine* the verse later collected as 'Lyra Apostolica' (1836); and in the 'Tracts for the Times,' he wrote Tract 80, 'Reserve in Communicating Religious Knowledge,' the subject of much discussion. In 1842 he was an unsuccessful candidate for the Oxford chair of poetry, the defeat being regarded as also the first for the Tractarians as a party. From 1842 to 1848 he was curate at Dartington, and afterward resided at Stinchcombe, where he assisted somewhat in the clerical duties of the parish. Among his further publications are several books of poetry, such as 'The Cathedral' (1838; 8th ed., 1859; reprinted 1889 ed. Benham); 'Thoughts in Past Years' (1838; 6th ed. 1852); and 'The Baptistry, or the Ways of Eternal Life' (1842–44; 6th ed., 1863); and some

volumes of prose, chiefly sermons. 'Selections' from his writings appeared in 1890; his 'Autobiography' in 1892.

WILLIAMS, James Douglas, American politician: b. Pickaway County, Ohio, 16 Jan. 1808; d. Indianapolis, Ind., 20 Nov. 1880. After a common-school education, he became a farmer in Knox County, Ind., first held office in 1838 as justice of the peace for Harrison township in that county, and in 1843 was elected as a Democrat to the house of representatives in the general assembly. He sat in the house during seven sessions, and in the senate for 12. In 1874 he was chosen to Congress, where he served until 1876, resigning upon his nomination as governor of Indiana. He was elected to the office in October, after a vigorous contest, his Republican opponent being Gen. Benjamin Harrison. His administration was one of economy and stability. His chief interest was in connection with the development of the agriculture of Indiana, and he was an incorporator and president of the State Board of Agriculture. He was widely known by his sobriquet of "Blue Jeans."

WILLIAMS, Jesse Lynch, American author: b. Sterling, Ill., 17 Aug. 1871. He was graduated at Princeton in 1892 and has published 'History of Princeton University' with J. De Witt (1898); 'The Stolen Story and Other Newspaper Sketches' (1899); 'The Adventures of a Freshman' (1899); 'New York Sketches' (1902); 'The Day Dreamer' (1906); 'My Lost Duchess' (1908); 'The Girl and the Game, and other College Stories' (1908); 'Mr. Cleveland, a Personal Impression' (1909); 'And So They Were Married,' a comedy (1915); 'Remaking Time' (1916), etc.

WILLIAMS, John, English prelate, archbishop of Canterbury: b. Aberconway, Carnarvonshire, Wales, 25 March 1582; d. Glodded, 25 March 1650. He was educated at Cambridge, took orders in the English Church in 1609, succeeded Bacon as keeper of the great seal in 1621, an office which he held till 1626, and was consecrated bishop of Lincoln in November 1621. Though a favorite with James I he incurred the dislike of Charles I, and having supported the Petition of Right in 1628, was prosecuted by Laud before the Star Chamber, charged with betraying the king's secrets. After eight years' legal proceedings he was suspended from his see, fined successively £10,000 and £8,000 and imprisoned in the Tower, 1636–40. Released by the Long Parliament and restored to his see, he was made archbishop of Canterbury in 1641, but was again sent to the Tower with 11 other bishops on account of their protest against the validity of acts passed during their enforced absence from the House of Lords. He was released in 1643 and during the civil war supported the royal cause and fortified and held Conway Castle. Consult 'Scrinia Reserata,' a Latin life of the prelate, by Hacket and Philips (1700).

WILLIAMS, John, American clergyman, known as "the redeemed captive": b. Roxbury, Mass., 10 Dec. 1664; d. Deerfield, Mass., 12 June 1729. He was graduated from Harvard in 1683, was settled in Deerfield in 1686, and ordained in 1688. On 29 Feb. 1704, a party of 300 French and 142 Indians surprised the town, and some of them, breaking open Williams' house, killed two of his children and his negro servant, and forced him with his wife and six of his surviving children (his son Eleazer was absent) to set out with other prisoners for Canada. On the second day's march Mrs. Williams fell from exhaustion, and was dispatched with a tomahawk. About 20 other prisoners were murdered under similar circumstances. On his arrival in Canada, after a journey attended by almost unexampled hardships, Williams was treated by the French with great humanity and even courtesy, and at length was redeemed, and arrived in Boston, 21 Nov. 1706, with 57 other captives, among whom were two of his children. His daughter Eunice, 10 years of age, was left behind, and married an Indian. Williams, soon after his return, resumed his pastoral charge at Deerfield and published a narrative of his captivity, entitled 'The Redeemed Captive Returning to Zion' (1707), a narrative of his adventures which furnishes a good picture of the frontier dangers of the time.

WILLIAMS, John, English missionary: b. Tottenham, Middlesex, 29 June 1796; d. Erromango, New Hebrides, 20 Nov. 1839. At 14 he was apprenticed to an ironmonger, but having offered himself to the London Missionary Society, was sent in 1816 to Eimeo, one of the Society Islands. Later he settled in Raiatea, the largest of the group, and labored here with marvelous success, his powers of organization being as conspicuous as his zeal. In 1823 he went to Raratonga, the chief of the Hervey Islands, where he met with continued success. He next built a boat with his own hands in which during the next four years he visited many of the South Sea Islands, extending his missionary labors to the Samoa Islands. In 1834 he returned to England, there superintending the printing by the Bible Society of his Raratongan New Testament, and raising $20,000 to equip a missionary ship for Polynesia. In 1838 he went out again, visited many of the stations he had already established, and sailed as far west as the New Hebrides, where he hoped to plant a mission, but was killed and eaten by the savages natives of Erromango. He published 'Narrative of Missionary Enterprises' (1837). Consult the biographies by Campbell (1842) and Prout (1843).

WILLIAMS, John, American Protestant Episcopal bishop: b. Deerfield, Mass., 30 Aug. 1817; d. Middletown, Conn., 7 Feb. 1899. He was graduated from Harvard in 1835, studied theology and was ordained deacon in 1838 and priest in 1841. From 1837 to 1840 he was tutor in Washington (now Trinity) College, then was for a time assistant minister of Christ Church, Middletown, Conn., and rector of Saint George's, Schenectady, N. Y., 1842–48. In 1848 he was elected president of Trinity College and professor of history and literature. He was consecrated assistant bishop of Connecticut in 1851, but retained the presidency of Trinity for two years longer, and then became vice-chancellor. Several students for holy orders having placed themselves under his direction, an informal theological department grew up, which was afterward incorporated as the Berkeley Divinity School at Middletown, Bishop Williams remaining the principal instructor. On

the death of Bishop Brownell in 1865, he assumed sole charge of the diocese, whose administration had for a long time been practically in his hands, and at the same time became chancellor of Trinity College. In the General Conventions of 1883 and 1886, he was chosen chairman of the House of Bishops, and in 1887 succeeded Bishop Lee as presiding bishop of the Episcopal Church. His published works include 'Thoughts on the Gospel Miracles' (1848) and 'Studies in the Book of Acts' (1888).

WILLIAMS, John Joseph, American Roman Catholic prelate: b. Boston, Mass., 22 April 1822; d. there, 30 Aug. 1907. His elementary education was obtained at the cathedral parochial school; in the Sulpician College, Montreal, Canada, he studied philosophy, and later theology with the Sulpicians in France. In 1845 he was ordained priest by Archbishop Affre and upon returning to Boston, Mass., was appointed assistant at the cathedral, in 1855 becoming its rector. Two years later he was made vicar-general of the diocese and rector of Saint James' Church, both of which positions he held for nine years, being then chosen coadjutor to Bishop Fitzpatrick, whose death, however, occurred before the arrival of the papal bulls for Father Williams' consecration. Therefore, on 11 March 1866, Father Williams was consecrated bishop of Boston. A vast territory was then under his jurisdiction, as his diocese included the entire State of Massachusetts, but when, in 1870, Bishop Williams went to Rome to attend the Vatican Council, he applied for the division of his diocese, the result being that Springfield, Mass., was erected into an episcopal see. In 1875 Pope Pius IX elevated Boston to a metropolitan see, Bishop Williams becoming its first archbishop, the pallium being conferred upon him 2 May 1875. Foremost among the monuments to his zeal and energy are the new Holy Cross Cathedral of Boston and Saint John's Theological Seminary.

WILLIAMS, John Sharp, United States senator: b. Memphis, Tenn., 30 July 1854. He is the descendant of one of the most distinguished of Southern families, whose founder was John Williams, member of the Continental Congress. John Sharp Williams studied at the Kentucky Military Academy, the University of the South, at Sewanee, Tenn., and at the University of Virginia. His general training was completed at the University of Heidelberg, Germany; but on his return home he studied law at the University of Virginia and privately at Memphis. In 1878 when he was only 24 years old he settled at Yazoo, Miss., where he arose immediately to eminence at the local bar. Following the bent of Southerners he also became a landowner and planter. In the early '90s he began to take an active interest in politics and was elected to the national House of Representatives where he remained from 1893 to 1909. He entered Congress in the midst of that trying period when all the agricultural interests of the country were sorely depressed and when laboring men were uniting with farmers' organizations in the hope of weakening the grip of financiers and industrial leaders upon the government. Williams was in full sympathy with their efforts. He was an ardent advocate of a low tariff, if not an advocate of actual free trade. He was a member of that group of earnest Democrats who opposed President Cleveland in 1895 when the so-called gold bonds were issued to a syndicate controlled by Messrs. Belmont and Morgan of New York, as a means of maintaining the credit of the treasury. Mr. William Jennings Bryan was the leader of these protesting Democrats. Early in 1895 Mr. Williams signed, with Bryan and 31 other leaders of Congress and newspapermen, an address to the people which had a great influence upon the history of the country. It proved to be the beginning of the campaign of Mr. Bryan for the control of the Democratic National Convention of 1896. It was not only a protest against the proposed gold standard, for which Eastern men, Democratic and Republican, were clamoring; it was an appeal to independent Democrats very much like that which Salmon P. Chase and others issued to the country against the famous Nebraska bill of 1854. It rallied the whole West, regardless of party, and when the Republicans met in convention in Saint Louis, it was with great difficulty that the party was prevented from declaring against the gold standard. But the Democratic National Convention which met in Chicago was entirely won and Mr. Bryan was made candidate for the Presidency. Mr. Williams was an earnest champion of free trade and free silver and as such had a large share in the extraordinary campaign in which both issues were lost. Williams continued an influential member of the House of Representatives and during the Roosevelt Presidency he was the leader of the minority, a witty, alert and forceful critic of governmental measures. Although he was never an organizer, nor a politician except in the better sense, he was twice the undisputed candidate of his party for speaker. The last time he offered for Congress in his district, he received every vote cast. But he had already made up his mind to enter the Senate. It was at the time of the growing Vardaman movement in Mississippi. Notwithstanding the popularity of Governor Vardaman, who opposed Williams, the latter easily won a seat in the Senate. The issue was mainly the question of the negro in the State, Williams taking the more moderate attitude that there would be no negro question if it were left out of party politics. In the Senate Williams fought persistently for a lower tariff, although he broke with Bryan and many of his earlier political friends, and in 1911 aided in the passage of the Underwood tariff which President Taft vetoed. When President Wilson entered office Williams became a warm supporter of the great reforms, tariff, finance and income tax laws, which were made effective in 1913 and 1914, after all realizing the purposes of the movement of 1896. He was almost from the beginning of the European War an advocate of American intervention, and when the country entered the war he was an earnest supporter of the Allied cause, while his colleague from Mississippi, Senator Vardaman, took the opposite view. In the winter of 1919 Williams was the only senator who voted against a resolution urging President Wilson to press the cause of Ireland, against the wishes of the British government, before the Paris Peace Conference. He declared that Congress should not interfere in the internal relations of a friendly power.

WILLIAMS, John Skelton, American financier, government official and railroad organizer: b. Powhatan County, Va., 6 July 1865. He was educated at the University of Virginia, and engaged in banking and other business undertakings at Richmond, gaining a large fortune. He organized the Seaboard Air Line under Southern control and capital, and was its president in 1894–1904. He has been actively interested in the development of Southern resources. He was appointed Assistant Secretary of the Treasury in 1913, and in 1914 became Comptroller of the Treasury, serving also as an ex-officio member of the Federal Reserve Board. In 1918 he was appointed a member of the advisory committee to the Director-General of Railroads and also director of the division of finances and purchases in the department of railroads.

WILLIAMS, John Stuart, American senator and Confederate soldier: b. Montgomery County, Ky., 1820; d. there, 17 July 1898. He was graduated at Miami (Ohio) University in 1838, and was admitted to the bar of Kentucky in 1840. He served in the Mexican War, was promoted to the rank of colonel and afterward resumed his law practice. He was a member of the Kentucky State legislature in 1851–52. He was opposed to the secession of the Southern States, but organized a brigade for service in the Confederate army and served as brigadier-general throughout the war. He later urged speedy renewal of allegiance to the United States. He served in the Kentucky legislature in 1873–74, and was United States senator in 1879–85.

WILLIAMS, Jonathan, American soldier: b. Boston, Mass., 20 May, 1750; d. Philadelphia, Pa., 16 May 1815. He was secretary to his granduncle, Benjamin Franklin, while the latter was Ambassador to France, and while abroad read widely concerning fortification and made an especial study of military science. He returned with Franklin in 1785 and was for some years a judge of Common Pleas at Philadelphia. In 1801 he entered the army, soon becoming inspector of fortifications and taking command of West Point in 1802–03. He resigned in the year last named, but returned to the army in 1805 as chief engineer and superintendent at West Point. While in charge of the fortifications of New York he built Fort Columbus and Castle William on Governor's Island, Castle Clinton (Castle Garden), and Fort Gansevoort. On the breaking out of the War of 1812, as senior officer at Castle William, he claimed command of that fort, and on his being assigned elsewhere, he resigned. He was elected to Congress in 1814, but did not take his seat. As the first person in the United States to apply the principles of scientific engineering he has often been called "the father of the corps of engineers." He published 'The Use of the Thermometer in Navigation' (1799) and translated 'Elements of Fortification' (1801), and 'Kosciusko's Manœuvres for Horse Artillery' (1808).

WILLIAMS, Sir Monier Monier-. See Monier-Williams, Sir Monier

WILLIAMS, Roger, pioneer of religious liberty and founder of Rhode Island: b. Wales, 1607; d. Providence, R. I., March 1684. There is considerable doubt as to the year of Williams' birth; authorities differ. Some of them claim he was born in 1601, others in 1603. The writer after a careful examination of all the records places the date at 1607. Consult Straus' 'Roger Williams, the Pioneer of Religious Liberty,' pp. 5–11.

The most recent investigations have shown that he was the son of James Williams, a merchant tailor of London, and of his wife, Alice Williams. While yet a mere boy, he attracted the attention of Sir Edward Coke, while taking shorthand notes of sermons and speeches in the Star Chamber, and Coke placed him (1621) in the Charter House School. From there (1623) he went to Pembroke College, Cambridge University, from which he took his degree in 1626. Williams soon developed into a decided opponent of the liturgy and ceremonies of the Church, thereby placing himself on the side of the most radical Puritans. On 1 Dec. 1630 he embarked from Bristol with his young wife in the ship *Lyon*, and arrived at Nantasket 5 Feb. 1631. No sooner had he set foot upon the shores of New England than he came in conflict with the ecclesiastical and civil authorities of the colony, whom he found arrayed against him, for asserting and maintaining with unwavering fidelity those principles which have immortalized his name as the champion of religious liberty.

The arrival of Williams in America was noted by Winthrop as that of a "Godly minister." He was already known and esteemed by the leading men in the colony, and he was immediately invited to officiate in the place of John Wilson as teacher of the church at Boston, which, however, Williams declined on the ground that they of Boston were an unseparated people. It is well to note here a distinction between the Pilgrims and the Puritans. The former were Separatists, and were associated as a distinct church before they left Holland. A principle of their Church was, that the state had no right to punish for spiritual sins. The Puritans, on the other hand, though Nonconformists, were not separated from the Established Church. Their scruples were against conforming to many of the ceremonies of that Church. He was invited by the Pilgrim church at Salem to become an assistant or teacher in place of Higginson, who died a few months before. This call Williams accepted, but the civil authorities, the General Court of Boston, interfered and remonstrated with the Salem church for choosing him. He remained at Salem only a short while, and in August removed to Plymouth, where he was received with much respect. Here he remained for two years, supporting himself by manual labor and officiating as "teacher" in the church among the Pilgrim fathers. During his residence here he became intimately acquainted with various Indian chieftains in the neighborhood, which intimacy had an important bearing in his subsequent life in the founding of Rhode Island.

In August 1633 he returned to Salem and resumed his ministerial labors there, but at every turn he found himself in conflict with the clergy and the court of Massachusetts. He was frequently cited to appear before the court. In October 1635 he was tried before the General Court, consisting of the governor, the deputy

governor, eight assistants and some 25 deputies. The formal charges against him were four in number, but the basis of them may be summed up by the statement that he maintained that the civil power has no jurisdiction over the conscience, or, in other words, he maintained the absolute liberty of conscience. The court convicted him and sentenced him to banishment. In January 1636 he left Salem to escape arrest, and to seek a refuge from the tyranny of the church brethren. He went first to Seekonk, and afterward with four companions who joined him embarked in a canoe to seek a spot beyond the jurisdiction of the Massachusetts and Plymouth colonies. The site selected by him was Providence, so named by him in gratitude for "God's merciful providence to him in his distress."

In March 1638 a large section of land was conveyed to him by deed from the Indians, which land he divided equally among his followers. Mrs. Williams and her two infant children joined him, and friends from Massachusetts and England soon joined the Rhode Island colony.

William Coddington, who had been a merchant in Boston, was elected as magistrate with the title of judge, and three elders were elected to assist him. This form of government continued until 1640. Meanwhile the antagonism of the Boston Colony to Williams continued, and a law was passed which practically excluded the inhabitants of Providence from entering Massachusetts. In March 1641 the government of Rhode Island was regularly organized.

The formation of the New England Confederacy, in 1643, which included the four colonies, Massachusetts, Connecticut, Plymouth and New Haven, was a matter of anxious concern to the Rhode Island and Providence settlements. The open hostility of the Confederacy, together with the claim made by Massachusetts that the Rhode Island and Providence colonies had no authority to set up civil government, induced these latter colonies to seek a charter from England. At an assembly held in Newport 19 Sept. 1642, a committee was appointed to procure a charter, and in July 1643 Williams set sail from New York for England. Here on 17 March 1644 he obtained a charter which gave to the towns of Providence, Portsmouth and Newport full power to rule themselves under the name "The Providence Plantations of Narragansett Bay." This charter granted in the most friendly spirit everything that Williams prayed for.

Williams returned to America in 1644, landing in Boston 17 September. He ventured to tread on this forbidden ground by exhibiting a letter from 12 leading members of the Parliamentary party in England, addressed to the government of Massachusetts. He, therefore, proceeded without hindrance to Providence. In May 1647 a form of government was agreed upon after many delays; the office of president of the colony, which so naturally belonged to Williams, was bestowed upon John Coggeshall of Newport. Dissensions arose within and without the new colony; Williams was called upon to pacify the Indians and to settle numerous disputes, ecclesiastical and civil. In October 1652 Williams was again in England making efforts to secure a renewal of the colony's charter; this he secured and returned to America, landing in Boston in 1654. In this same year the reorganization of the Rhode Island government took place, and on 12 September Williams was elected president of the colony. He was again elected 20 May 1656. In this year the persecution of the Quakers in Boston soon made Rhode Island a Quaker refuge, and they were made welcome largely through the influence of Roger Williams. For many years, until 1677, Williams continued to hold various offices and to guide the affairs of the colony. In the Indian wars of 1675–76, when Providence was attacked, Williams was captain of militia and drilled companies in Providence. See RHODE ISLAND.

The life of Roger Williams was now rapidly nearing its end. His Providence friends did not fully appreciate the life-work of this sturdy champion of soul liberty, which was destined to bring happiness to a continent. At his death the brief record was conveyed to the outer world in a letter dated 10 May 1684, stating "The Lord hath arrested by death our ancient and approved friend, Mr. Roger Williams, with divers others here." He was buried in a spot which he himself had selected on his own land, near where, 47 years before, he had first landed within the colony he founded.

The principles of religious liberty had been proclaimed in all ages and under many climes, with more or less plenitude, but Roger Williams was the first to organize and build up a political community with absolute religious liberty as its chief cornerstone. To him the successful pioneer of these principles is due to a larger extent than to any man, the American system of a "free church in a free State."

No portrait of him in bronze or in marble, or of any kind, has come down to us, and when in 1872 the State of Rhode Island presented a statue of her founder to the nation, which now stands in the rotunda of the Capitol at Washington, the artist had to make the memorial from an ideal conception.

Among the great men of his times with whom Williams stood in close personal relations, besides his early patron, Sir Edward Coke, were Cromwell, John Milton, Sir Henry Vane, the younger, Major-General Harrison of the Parliamentary army, Lawrence Lord, president of the Council of State, and others of distinction in England and America. (See UNITED STATES — CIVIL AND RELIGIOUS LIBERTY). Consult 'Memoirs,' by James D. Knowles (Boston 1833); Gammell (Boston 1846); Elton (London 1842); Guild, R. A., 'Biographical Introduction, etc.' (Providence 1866); 'Works of Roger Williams,' published by the Narragansett Club of Providence (6 vols., Providence 1866–74); biographies by Oscar Straus (New York 1894) and Carpenter, E. J. (ib. 1910); Tyler, M. C., 'History of American Literature, 1607–1765' (New York 1878); Dexter, Henry M., 'As to Roger Williams and his "Banishment" from the Massachusetts Plantation' (Boston 1876).

WILLIAMS, Rowland, Anglican clergyman and educator; b. Halkyn, Wales, 16 Aug. 1817; d Broad Chalk, near Salisbury, Wiltshire, 18 Jan. 1870. He was graduated from King's College, Cambridge, in 1841, and was Fellow and

tutor there in 1839–50. He accepted the chair of Hebrew at the theological college of Saint David's in 1850, acting also as vice-president of that institution. In 1854 he became select preacher at Cambridge and became vicar of Broad Chalk in 1858, while still retaining his offices at the college. His views on inspiration brought him into disfavor with the Welsh clergy and in 1862 he was prosecuted and condemned for heresy in the Court of Arches. He resigned his professorship and retired to his vicarage at Broad Chalk, where he henceforth lived, though in 1864 he secured from the Privy Council a reversal of the judgment against him. His publications include 'Rational Godliness' (1855); 'The Hebrew Prophets' (1868–71); 'Psalms and Litanies' (1872), etc. Consult Williams, Ellen, 'Life and Letters of Rowland Williams' (1872).

WILLIAMS, Samuel Wells, American missionary and philologist: b. Utica, N. Y., 22 Sept. 1812; d. New Haven, Conn., 17 Feb. 1884. He was graduated from the Rensselaer Institute, Troy, N. Y., in 1832, and in 1833 went to Canton, China, as printer to the American Mission. He was compelled to remove to Macao in 1835, and in 1845–48 was in the United States, after which he resumed his work in Canton. He acted as interpreter to Commodore Perry on his Japanese mission in 1853–54, and in 1857 resigned his position in the mission and became secretary and interpreter to the United States legation. He assisted in the negotiation and ratification of the treaty of Tientsin in 1858–59. Upon the establishment of the United States legation at Peking under Burlingame in 1862 he became its secretary, occupying the post until 1876, when he returned to the United States and accepted the chair of Chinese at Yale, where he remained until his death. He was editor and contributor to the *Chinese Repository* during the time of its publication (1832–51), and was a leading authority on the Chinese and Japanese languages. He superintended the press work of Medhurst's 'Dictionary of the Hokkien Dialect' (1837) and with Bridgman issued 'Chinese Christomathy' (1841). His other works include 'Easy Lessons in Chinese' (1842); 'The Topography of China' (1844); 'The Middle Kingdom' (1848); 'A Syllabic Dictionary of the Chinese Language' (1874), etc. The two last mentioned are the greatest of his works and are still among the highest authorities in their field. Consult Williams, F. W., 'Life and Letters of Samuel Wells Williams' (1888).

WILLIAMS, Seth, American soldier: b. Augusta, Me., 22 March 1822; d. Boston, Mass., 23 March 1866. He was graduated at the United States Military Academy in 1842, and in the Mexican War served as aide-de-camp to Gen. Robert Patterson. He was adjutant of the United States Military Academy in 1850–53, and was thenceforth until his death connected with the adjutant-general's office. He was promoted brigadier-general of volunteers 23 Sept. 1861, and later served as adjutant-general on the staff of Generals McClellan, Burnside, Hooker and Meade. From 1864 until the close of the war he was inspector-general of the army on the staff of General Grant. He was brevetted major-general of volunteers 1 Aug. 1864 for conduct at Gettysburg, and major-general of regulars 13 March 1865 for his services in the war. His health was seriously undermined in the war but he remained on duty.

WILLIAMS, Talcott, American journalist and educator: b. Abeih, Turkey, 20 July 1849. His parents were Congregationalist missionaries. He was graduated at Amherst College in 1873. He was on the staff of the New York *World* in 1873–77; was Washington correspondent of the New York *Sun* and of the San Francisco *Chronicle* in 1877–79; and was editorial writer on the Springfield (Mass.) *Republican* in 1879–81. He was one of the editors of the Philadelphia *Press* in 1881–1912. Since 1912 he has been director of the School of Journalism founded at Columbia University by Joseph Pulitzer. He was president of the American Conference of Teachers of Journalism in 1913. Dr. Williams was associate editor of the second edition of the 'New International Encyclopædia.' He has been the recipient of honorary degrees from almost a dozen prominent institutions of higher learning.

WILLIAMS, Walter, American journalist and educator: b. Boonville, Mo., 2 July 1864. He was editor and part owner of the Boonville *Advertiser* in 1884–89; and edited the Columbia (Mo.) *Herald* in 1890–1908. He also edited the Saint Louis *Presbyterian* in 1897–98; the *Daily State Tribune*, Jefferson, Mo., in 1898–1902; and founded the *Country Editor* in 1895. Since 1908 he has been professor of the theory and practice of journalism at the University of Missouri, serving also as dean. He was the organizer and secretary of the World's Press Parliament held at Saint Louis in 1904; was elected the first president of the Press Conference of the world for 1916–20; and was the first president of the American Association of Schools and Departments of Journalism in 1916. He has published 'Some Saints and Some Sinners in the Holy Land' (1902); 'History of Missouri' (1908); 'From Missouri to the Isle of Mull' (1909); 'The Practice of Journalism' (1911); 'The World's Journalism' (1915); 'History of Northeast Missouri' (1915); 'History of Northwest Missouri' (1915).

WILLIAMS, William, American patriot and signer of the Declaration of Independence b. Lebanon, Windham County, Conn., 8 April 1731; d. there, 2 Aug. 1811. He was graduated at Harvard College in 1751, in 1755 served on the staff of Col. Ephraim Williams in the Lake George expedition, and after the revolutionary troubles began was an active member of the council of safety, and in October 1775 was chosen a representative in the Continental Congress. His property was nearly all expended in the war, and he was tireless in obtaining private donations to supply the army, going from house to house to collect articles that could relieve the destitution of the soldiery. He held nearly every office in the gift of his constituents, served nearly 50 years in the State legislature, and was a member of the convention of his State which adopted the Federal Constitution.

WILLIAMS, Sir William Fenwick, British soldier: b. Annapolis Royal, Nova Scotia, 4 Dec. 1800; d. London, 26 July 1883. He was

Poughkeepsie, N. Y., 19th century. She was educated privately and became known as a writer of fiction. Later she collaborated with her husband in writing novels which made their joint signatures "A. M. and C. N. Williamson" widely known. Independently she was the author of 'The Barn Stormers'; 'The Golden Silence,' etc.

WILLIAMSON, Charles Norris, English journalist and novelist: b. Exeter, 1859. He was educated at University College, London, and engaged in journalism. He worked for the *Examiner* and on the *Graphic*, and in 1891 founded *Black and White*. He wrote numerous magazine articles and 'Life of Thomas Carlyle' (2 vols., 1881). He is best known, however, for the novels written in collaboration with his wife, A. M. Williamson (q.v.), under their joint signatures. Among them are 'The Lightning Conductor' (1903); 'The Princess Passes' (1905); 'The Car of Destiny' (1906); 'Set in Silver' (1909); 'The Motor Maid' (1911); 'The Heather Moon' (1912); 'It Happened in Egypt' (1914); 'The Lightning Conductor Discovers America' (1916); 'Tiger Lily' (1917)'; 'Everyman's Land' (1918); 'The Lion's Mouse' (1919).

WILLIAMSON, Francis John, English sculptor: b. Hampstead, England, 17 July 1833. He was a pupil of J. H. Foley and later became his assistant, afterward settling at Esher, Surrey, where he has since lived. He has executed many ideal and private commissions, including portraits of the royal family at the order of Queen Victoria. Among his works are statues of Queen Victoria in Australia, India, Ireland, London, etc.; Dean Milman in Saint Paul's Cathedral; and numerous public statues in different parts of the British Isles.

WILLIAMSON, George Charles, English writer on art: b. Guildford, Surrey, 1858. He was educated at London University. As an author he began with newspaper articles on local archæological matters and issued a small book on local coins. He also wrote a book on trader's tokens and another on coins of the Bible. For many years he has been art editor to George Bell and Sons, publishers. He has traveled extensively, visiting the picture galleries of Europe, both public and private. Mr. Williamson is the author of 'Life of John Russell, R.A'; 'John Downman'; 'Richard Cosway, R.A.'; 'George J. Pinwell'; 'Portrait Miniatures'; 'Bernardino Luini'; 'George Engleheart'; 'Velasquez'; 'Holman Hunt'; 'Lord Leighton'; 'Murillo'; 'Raphael'; 'Cities of Northern Italy'; 'Andrew and Nathaniel Plimer'; 'History of Portrait Miniatures'; 'The Anonimo Morelliano'; 'How to Identify Portrait Miniatures'; 'Life of George Morland'; 'Life of Milton'; Guildford in the Olden Time'; 'Catalogue of the Pierpont Morgan Collection of Miniatures' (4 vols.); 'Catalogue of the Pierpont Morgan Collection of Jewels'; 'Catalogue of the Pierpont Morgan Collection of Watches'; 'The Imperial Wedgwood Dinner Service'; 'Miniatures, English and Foreign'; 'Catalogue of the Portraits of Milton,' etc. Mr. Williamson is editor of a new edition of Bryan's 'Painters and Engravers' (5 vols.) and was a collaborator in *The Catholic Encyclopedia*.

WILLIAMSON, Hugh, American physician and legislator: b. West Nottingham, Pa., 5 Oct. 1735; d. New York, 22 May 1819. He was graduated at the College of Philadelphia in 1757, studied theology and in 1759 was licensed to preach in Connecticut. He preached for a time and was professor of mathematics at the College of Philadelphia in 1760–63. He then studied medicine at the universities of Edinburgh and Utrecht, and became a highly successful practitioner in Philadelphia. While in England in 1774 he was examined by the Privy Council in regard to the affairs of the American colonies. He was a surgeon in the North Carolina militia in 1780–82; served in the Continental Congress in 1784–86; and in 1787 was a delegate to the convention which framed the Constitution of the United States. He served in Congress from its first organization until 2 March 1793, when he removed to New York. He wrote 'Paper Currency' (1786); 'Discourse on the Benefits of Civil History' (1810); 'History of North Carolina' (2 vols., 1812), etc.

WILLIAMSON, W. Va., city and county-seat of Mingo County, situated on the Norfolk and Western Railroad, 75 miles southeast of Huntington. The chief public buildings are the county courthouse, city hall and public schools. Because of its location in the coal-producing region of the State, coal-mining is its chief industry. In 1916 the commission form of government was put in operation. Pop. 3,561.

WILLIAMSON FREE SCHOOL OF MECHANICAL TRADES, an educational institution for boys dependent upon their own resources, founded in 1888 at Williamson School Station, near Philadelphia, Pa., by I. V. Williamson. It is non-sectarian and preference in admission is given to boys in the surrounding sections. Boys between the ages of 15 and 18 are admitted, and are bound for three years as apprentices to the trustees. There is an academic course for general education and each student is taught one trade, which may be carpentering, brick laying, machine trade, pattern making, steam and electrical engineering or agriculture. The students live in cottages in families of 24 or less. The endowment is about $3,000,000. There are 20 instructors and assistants, and about 250 students are accommodated. The library contains about 4,000 volumes.

WILLIAMSPORT, wĭl'yamz-pōrt, Ind., city, county-seat of Warren County, on the Wabash River and the Wabash Railroad, 71 miles northwest of Indianapolis. It was founded in 1827. It is the trade centre of an agricultural region, and is also situated within three miles of large coal mines; it has a building-stone quarry, grist-mills and warehouses; there are two State banks and two weekly newspapers. There is a high school founded in 1884. Pop. about 1,243.

WILLIAMSPORT, Md., town in Washington County, on the Potomac River, the Chesapeake and Ohio Canal, and the Cumberland Valley and West Maryland railroads, 65

miles northwest of Washington. It was founded in 1787; in 1863 Lee's army crossed the Potomac at this point on the march to Gettysburg. It is situated in an agricultural and timber region, and is a shipping point for peaches. It has flour and lumber mills and sash and door factories, a national bank with a capital of $100,000 and one weekly newspaper. There is a high school, and several elementary schools, including one for colored pupils. Pop. about 1,571.

WILLIAMSPORT, Pa., city, county-seat of Lycoming County, on the West Branch of the Susquehanna River, and on the Pennsylvania, the Northern Central, and the Philadelphia and Reading railroads, about 75 miles north of Harrisburg. It is on the Alleghany plateau, covering an area of seven square miles, in an agricultural and mining region. The chief manufacturing establishments are steel works, lumber mills, furniture and rubber goods factories, wood-working machinery works, wire rope, nail and engine factories, boot and shoe factories, silk mills, a sewing-machine factory and fire escape works. In 1918 the estimated number of wage-earners was 6,500, and of wages paid over $3,000,000. The gross production of these factories was nearly $14,000,000 in the census year, and fully $20,000,000 in 1918. The city has an extensive trade in lumber products and coal. Williamsport was for many years a shipping point for lumber, being styled the "Sawdust City." But as the forests were cut the trade disappeared, and numerous foundry and machine shops were located here; gas and gasolene engines are manufactured, also rubber goods, woolen and silk goods, furniture, shoes, etc.

The principal public buildings are the government building, city hall, opera house, city hospital, Home for the Friendless and Masonic Temple. The city has two parks, Brandon and Vallamont; and Sylvan Dell and Starr Island are near by. There are over 50 churches, with 17,000 communicants. The educational institutions are Dickinson Seminary (Methodist Episcopal), a high school opened in 1869, 14 public schools, two large Roman Catholic parish schools and two commercial colleges. There are two dailies and one Sunday newspaper, besides several weeklies and a tri-weekly. The Sunday newspaper *Grit*, has a national circulation.

Williamsport was settled in 1779, and set off as a town in 1795. In 1806 it was incorporated as a borough, and in 1866 was chartered as a city. The city grew slowly until 1850, when the lumber industry began. Since then the growth has been rapid and the manufacturing and commercial industries have kept pace with the population. Pop. 40,000.

WILLIAMSTOWN, Australia, a seaport in Victoria, on the southwest shore of Hobson's Bay, immediately opposite Port Melbourne and nine and one-quarter miles southwest of Melbourne. The business interests of the town largely centre in the shipping. The piers are commodious and there are shipbuilding yards, patent slips and a drydock called the Alfred Graving Dock, opened in 1874 and improved in 1897-98. There are glass works, a woolen mill and refrigeration plants. The chief buildings are the churches, the merchanics' institute, the customhouse, the sailors' rest, banks and similar structures, etc. Basalt and brown coal are worked near the town and several manufactures are carried on. Pop. about 16,000.

WILLIAMSTOWN, Mass., town in Berkshire County, on the Hoosac and Green rivers, and on the Fitchburg (Boston and Maine) Railroad, about five miles west of North Adams and 40 miles east of Troy, N. Y. It was settled in 1753 and was named West Hoosic. In 1765 it was incorporated and its name was changed to Williamstown in honor of Ephraim Williams. In 1793 Williams College (q.v.) was opened, since when it has been a favorite residential town. There are five villages within the town limits. The chief industrial establishments are a cotton mill, a large bleachery and large freight yards. Market gardening is carried on to quite an extent. Mission Park is so named because the movement for American foreign missionary work was started here. There are two banks, one national and one State. Pop. about 3,700.

WILLIAMSTOWN, Pa., borough in Dauphin County, 26 miles northeast of Harrisburg, on the Pennsylvania and the Williams Valley railroads. It is situated in an anthracite coal mining region, and has hosiery mills. The borough was settled in 1865 and was incorporated in 1888. Pop. 2,904.

WILLIMANTIC, wil-i-măn'tik, Conn., city in Willimantic County, at the confluence of the Willimantic and Natchaug rivers, and on the Central Vermont and the New York, New Haven and Hartford railroads, about 32 miles east of Hartford. It has the water power from the Willimantic River, which here has a fall of 91 feet within the city limits. The chief manufacturing establishments are the American Thread Company, cotton warp mills, print factories, silk mills, a foundry, machine shops, a spool factory and silk machinery works. The educational institutions are a State normal school, a high school, public graded schools, a large parish school, a public library containing about 6,000 volumes, and the Dunham Hall Library. There are two banks and a daily and weekly newspapers. It was incorporated as a borough in 1833 and in 1893 was chartered as a city. Pop. about 11,230.

WILLING, Thomas, American jurist, merchant and financier: b. Philadelphia, Pa., 19 Dec. 1731; d. there, 19 Jan. 1821. He was educated at Bath, England, and studied law at the Temple, London. He then returned to Philadelphia, where with Robert Morris he established the mercantile firm of Willing and Morris, which became the largest in the country. During the Revolution the firm was commissioned by Congress to purchase the military and naval supplies required by the government. Willing was mayor of Philadephia in 1763; and in 1767-74 was an associate justice of the Supreme Court of Pennsylvania. He was a member of the Continental Congress in 1774-75, and voted against the Declaration of Independence. However, when in 1780 the Continental army was hard pressed for funds he was prominent among the Philadelphians who raised £200,000, himself contributing £5,000. In 1781 he was one of the founders of the

Bank of North America, the first bank chartered in the country; and he was its president in 1781–92. He was likewise the first president of the United States Bank, founded in 1791.

WILLIS, H(enry) Parker, American financial expert: b. Weymouth, Mass., 14 Aug. 1874. He was graduated at the University of Chicago in 1894, took the degree of Ph.D. there in 1897, and later studied at Leipzig and Vienna. He was for a time engaged as a journalist; was assistant to the Monetary Commission in 1897–98; and was professor of finance at George Washington University in 1905–06 and 1907–10. He was expert to the Ways and Means Banking and Currency Committees of the House of Representatives in 1911–13; was appointed secretary to the Federal Reserve Board in 1914; and in 1916–17 he was president of the Philippine Insular Bank, Manila, P. I. He has been professor of banking at Columbia University since 1917. His published works include 'History of the Laun Monetary Union' (1901); 'Our Philippine Problem' (1905); 'Principles and Problems of Modern Banking' (1910); 'The Federal Reserve' (1915); 'American Banking' (1916).

WILLIS, Nathaniel Parker, American author: b. Portland, Me., 20 Jan. 1806; d. Idlewild, N. Y., 20 Jan. 1867. He was graduated from Yale in 1827 and was employed by S. G. Goodrich ("Peter Parley") to edit two annuals, the *Legendary* in 1828 and the *Token* in 1829. In 1828 he established at Boston the *American Monthly Magazine*, which, after he had conducted it for two and a half years, was merged in the New York *Mirror*. He then set out on a tour of travel through Europe, visiting France, Italy, Greece, European Turkey, Asia Minor, and finally England, with the rank of an attaché to the American embassy at Paris, but chiefly as a correspondent of the *Mirror*, for which he wrote his 'Pencillings by the Way,' later (1835) published in book-form. He returned in 1836, became in 1839 editor of the *Corsair*, a New York periodical (1839–40), and in the same year again went to England. He returned to New York in 1846 and subsequently directed two short-lived papers, *The New Mirror* (1843–44) and *The Evening Mirror* (1844–45). Once more in Europe in 1845–46, he became in the last-named year editor of *The Home Journal*, the most successful of all his journalistic ventures, in the management of which he was associated with George P. Morris (q.v.). Willis was from the first a facile versifier and a prose-writer of great reportorial cleverness. His scriptural poems were in their day very popular, and many are still readable; and his other verse, when nothing else, was metrically able. Sometimes it reached real poetic value and effective specimens of it have been preserved by the anthologist. His fiction, except the 'Slingsby' papers, written for the English *New Monthly*, is popular but not strong. 'Pencillings by the Way' (1835) abounds in talented sketches of contemporaries. Willis was the most successful American journalist of his time, and his vogue was great. Among his principal works are 'Pencillings by the Way' (1835); 'Inklings of Adventure' (1836); two dramas entitled 'Two Ways of Dying for a Husband' (1839); 'Loiterings of Travel' (1840); 'Dashes at Life with a Free Pencil' (1845); 'People I Have Met, or Pictures of Society and People of Mark, Drawn Under a Thin Veil of Fiction' (1850); 'Hurrygraphs' (1851); a 'Health Trip to the Tropics' (1853); 'Outdoors at Idlewild' (1854); 'The Rag-bag,' a collection of ephemera (1855); 'The Convalescent, His Rambles and Adventures.' Consult the 'Life' by Beers ('American Men of Letters,' 1885). There is an estimate of Willis in Lowell's 'Fable for Critics.'

WILLIS'S ROOMS. See ALMACK'S.

WILLISON, Sir John Stephen, Canadian journalist: b. Huron County, Ontario, 9 Nov. 1856. He engaged in journalism, became parliamentary correspondent of the Toronto *Globe*, and in 1890–1902 he was its editor. He was editor of the Toronto *News* from 1902, and in that position contributed largely to the defeat of the Reciprocity agreement of 1911 and the downfall of the Laurier administration. He was elected president of the Parliamentary Press Gallery in 1890; and of the Canadian Press Association in 1900. Since 1910 he has been Canadian correspondent of the London *Times*. He was knighted in 1913. He has written 'The Railway Question in Canada' (1897); 'Sir Wilfrid Laurier and the Liberal Party: a Political History' (2 vols., 1903); 'The United States and Canada' (1908); 'The New Canada' (1910).

WILLISTON, Samuel, educational benefactor: b. Easthampton, Mass., 17 June 1795; d. Easthampton, 18 July 1874. He was son of the Rev. Payson Williston, who served as Congregational pastor in Easthampton for 44 years. His education was interrupted by ill health; and he began to sell cloth-buttons made by his wife and assistants, the first manufactured in this country. Joel Hayden, of a neighboring town, invented machinery for the work, and went into partnership with Williston, who acquired large wealth in this and other manufactures. Besides giving freely to many objects, he founded (1840) the high-class preparatory school at Easthampton (Williston Seminary), his entire gifts to which were $770,000. To Amherst College he gave $150,000, and much to Mount Holyoke Seminary. His benefactions have been estimated at $1,500,000.

WILLISTON, Samuel, American lawyer and educator: b. Cambridge, Mass., 24 Sept. 1861. He was educated at Harvard University. He became assistant professor of law there in 1890, professor in 1895, and since 1903 has been Weld professor of law. He assisted in the codification of the Law of Warehouse Receipts and the Law of Stock Transfer. Besides contributions to legal publications he is author of 'The Law of Sales' (1909); 'Commercial Law' (1915); 'Negotiable Instruments' (1915).

WILLISTON, Samuel Wendell, American paleontologist and anatomist: b. Boston, Mass., 10 July 1852; d. 1919. He was graduated at the Kansas Agricultural College in 1872, took the degree of M.D., at Yale University in 1880 and that of Ph.D there in 1885. He was professor of anatomy at Yale in 1886–90; held the chair of historical anatomy and geology at the University of Kansas in 1890–1902, and was also dean of the Medical School there; and since 1902 he has been professor of paleontology at the University of Chicago. He

and this resulted in the evacuation of the other forts and the surrender of Wilmington. Wilmington was chartered as a city in 1866.

It is an important commercial city. Improvements in the harbor and river channel have been made by the Federal government at considerable cost. There are weekly steamboat lines to New York, Baltimore and points on the Cape Fear and Black rivers and a large import and export trade, both foreign and domestic.

Wilmington is a city of varied resources, being in the heart of a rich agricultural district and also a port city. Its harbor channel has a mean low depth of 26 feet, with 30 feet projected, and it has over 600,000 square feet of warehonse space, while 16 ocean-going ships can load at one time at its docks. Shipbuilding is one of the livest of industries, steel, concrete and wooden vessels being built here simultaneously. At Wilmington is located the only government steel shipyard in the South and the first government owned concrete shipyard in the country.

Other industries located in Wilmington include fertilizer factories, packing-houses, marine railways, candy, woodwork, tea-chest, box, metal and fish can factories, cotton, hosiery and lumber mills, while it is one of the biggest fertilizer distributing points in the country. Immense cotton compresses are located along its river front and exports of cotton to Europe amount to 500,000 bales annually. The commerce on the Cape Fear River at and below Wilmington averaged 945,361 tons, with an average valuation of $55,685,191 for the five calendar years ending in 1913, and during the five-year period ending 30 June 1915 the foreign exports increased 26 per cent and the imports increased 239 per cent. Even this normal time increase is expected to expand, due to development of trade with Latin America.

Wilmington has many churches and a thorough public school system, its schools being of modern type and all of brick. Its bank deposits in October 1919 were over $30,000,000.

Here is located the New Hanover County courthouse, as well as many other public buildings, including a new customs-house, costing over $600,000 and placed in commission in 1919. Many organizations for the social welfare of the community and for dispensing charity are in existence, while the city and county jointly carry on extensive health work, having most stringent regulations, with rigid inspections of food and dairies, while appropriating $30,000 annually for mosquito extermination work. Wilmington is governed by a council of six, representing as many wards, into which the city is divided, and a mayor. The estimated population of the city in 1919 was 45,000.

JAMES H. COWAN,
Secretary, Wilmington (N. C.), Chamber of Commerce.

WILMINGTON, Ohio, city, county-seat of Clinton County, on the Cincinnati and Muskingum Valley and the Baltimore and Ohio railroads, about 43 miles northeast of Cincinnati and 30 miles southeast of Dayton. It is an agricultural region. The chief manufacturing establishments are bent-wood and bridge-work factories, iron furnaces, machine shops, automobile parts factories, creameries and flour and lumber mills. The Wilmington College (Orthodox Friends) was established here in 1870. There are two banks and four newspapers, one of which is issued daily. Pop. about 4,491.

WILMINGTON, Capture of. After General Terry's capture of Fort Fisher (q.v.) 15 Jan. 1865, Terry posted his troops on an intrenched line across the peninsula, about two miles above the fort. An advance on Wilmington was not considered prudent until he could be reinforced, as General Hoke, the Confederate commander, was holding Fort Anderson, on the west bank of Cape Fear River, about midway between Fort Fisher and Wilmington, and on the opposite bank had thrown up a line of intrenchments across the peninsula in Terry's front, behind which he had about 4,500 men. Fort Anderson was an extensive earthwork, mounting 10 heavy guns, commanding the approaches by land and water and held by General Hagood's brigade of 2,000 men. General Grant ordered General Schofield, with the 23d corps, from Tennessee to the coast of North Carolina to co-operate with General Sherman. Schofield's troops arrived at Alexandria and Washington late in January, where they were detained some days by the ice in the Potomac. General Cox's division of 4,400 men went by steamers from Alexandria and landed on the peninsula, in rear of Terry, 9 February, raising Terry's command to 8,000 men. Schofield now took command; the fleet under Admiral Porter occupied positions in Cape Fear River and off the coast, covering both flanks of Terry's line, and, 11 February, Terry was pushed forward, supported by Cox, drove in Hoke's pickets and intrenched within 500 yards of his main line. An attempt on the 12th to turn Hoke's left by a co-operation of the army and navy was foiled by high winds and a violent storm. On the night of the 14th an attempt was made to move the pontoons upon their wagons along the beach with the troops; the wagons sank deeply in the sand, progress was very slow, and it having become evident that the pontoons could not be got up to the point of crossing of Masonborough Sound before daylight, when the enemy would discover the movement, the attempt was abandoned and attention turned to Hoke's right, where it would not be required to contend with the difficulties of both land and sea. On the 16th Cox's and Ames' divisions were crossed by steamboats to Smithville, on the right bank of the river, where they were joined by Col. O. H. Moore's brigade, of Couch's division, and a battery, and, on the 17th Cox with four brigades and the battery advanced along the main Wilmington road, driving the Confederate pickets and bivouacking near Fort Anderson, with his right resting on the river. Next morning the advance was resumed and the enemy driven within the works Moore's and Henderson's brigades were intrenched on the south side of the fort, while Cox, with his other two brigades, followed later by Ames' division, started around Orton Pond, covering the Confederate right, to gain the Wilmington road in rear of the fort, the distance to be traveled being about 15 miles. The guns of Fort Anderson opened fire on the two brigades confronting the fort, and the gunboats opened heavily on the fort, the monitor *Montauk* lying close to it and the others en-

firm in favor of the amendment, and it was passed (15 February) by a decided majority, but was not acted on by the Senate. It caused great agitation throughout the country. The principle involved long continued to be an important factor in party politics, its influence being affected by many fluctuations of opinion and political action; and it may be said finally to have triumphed through the act of 19 June 1862 forbidding slavery in "any of the Territories of the United States now existing, or which may at any time hereafter be acquired." Consult Stephens, 'Constitutional View of the Late War Between the States' (1868–70); Wilson, 'Rise and Fall of the Slave Power' (1872–77); Schouler, 'History of the United States of America Under the Constitution' (1899); Von Holst, 'Constitutional and Political History of the United States' (1899).

WILSON, Alexander, American ornithologist: b. Paisley, Scotland, 6 July 1766; d. Philadelphia, Pa., 23 Aug. 1813. In his 13th year he was apprenticed to a weaver, but after seven years abandoned the loom and adopted the life of a peddler. Three years were thus spent and in 1789, having already prepared a volume of poems for publication, he offered his muslins and solicited subscriptions for this work. It was published in 1790, but had little success; and he again returned to the loom. In 1792 he published 'Watty and Meg,' which, having appeared anonymously, was ascribed to Burns, though the style is very different. It is said to have had a sale of 100,000 copies in a few weeks. Having written a severe satire upon a person in Paisley, Wilson was thrown into prison, and was afterward compelled to burn the libel with his own hand at Paisley Cross. Upon his release he came to this country, arriving at Newcastle, Del., in 1794. He again resumed his former trade, but soon turned to schoolmaster, acting in this capacity in several places in Pennsylvania. While thus engaged at Kingsessing near Philadelphia, he became acquainted with William Bartram, the naturalist, and Alexander Lawson, an engraver, whose tastes and instructions stimulated his own talents. He had already undertaken long excursions for making ornithological researches, and devoted much time to the study, when he was engaged, in 1806, to assist in editing the American edition of Rees's Cyclopedia, and now began to prepare for the publication of his 'American Ornithology,' the first volume appearing in 1808, and the seventh in 1813. The interval had been passed in exploring different parts of the country for the purpose of extending his observations, collecting specimens, and watching the habits of birds in their native haunts. In 1813 the literary materials for the eighth volume of the 'Ornithology' were ready, but its progress was greatly retarded for want of proper assistants to color the plates. Wilson was, therefore, obliged to undertake the whole of this department himself, in addition to his other duties; and these multifarious labors soon exhausted his strength and brought about his death. All the plates for the remainder of the 'Ornithology' having been completed under Wilson's own eye the letter-press of the ninth volume was supplied by his friend, George Ord, his companion in several of his expeditions, who also wrote a memoir of Wilson to accompany the last volume, and edited the eighth. Four supplementary volumes, containing American birds not described by Wilson, were published by Charles Lucien Bonaparte (1825–33). An edition of the original work, with Bonaparte's continuation, and notes and life of Wilson by Sir William Jardine, was published in London in 1832. Wilson continued to write poetry after leaving Scotland, one of his chief productions being 'The Foresters,' a poem describing a pedestrian tour to the Falls of Niagara, and several collective editions of his poems have appeared. A bronze statue of Wilson has been erected at Paisley. Consult 'Life of Wilson,' by Peabody, in Sparks' 'Library of American Biography' (1834–56); Brightwell, 'Difficulties Overcome: Scenes in the Life of Alexander Wilson' (1860); Paton, 'Alexander Wilson, the Ornithologist' (1863); 'Leading Men of Science' (New York 1910).

WILSON, Allen Benjamin, American inventor: b. Willet, N. Y., 18 Oct. 1824; d. Woodmont, Conn., 29 April 1888. He was a cabinet maker by trade, but in 1849 invented a sewing machine which made a stitch at each movement of the shuttle, thus enabling the operator to make an endless seam at any curve, and thereafter devoted himself to its improvement. In 1851 he secured a patent for the rotating hook, and a year later invented the four-motion feed, which was subsequently adopted in all machines. In 1800 he entered into partnership with Nathaniel Wheeler (q.v.), with whom he established, at Bridgeport, Conn., the then largest factory in the world for the manufacture of sewing-machines. In 1852 on the reorganization of the firm, he withdrew from the business and settled in Waterbury, where he engaged in other enterprises. See SEWING MACHINES.

WILSON, Alpheus Waters, American bishop of the Methodist Episcopal Church, South: b. Baltimore, Md., 5 Feb. 1834; d. Baltimore, Md., 21 Nov. 1916. He was educated at Columbian College, Washington, D. C., was received into the Baltimore Methodist Conference in 1853; and, on the organization of the Baltimore Conference of the Methodist Church, South, identified himself with that body. He became the secretary of the board of missions of his Church in 1878, and was elected bishop in 1882. In 1894 he was a lecturer at Vanderbilt University, and was also author of a book on missions.

WILSON, Sir Archdale, English soldier: b. Didlington, Norfolk, 1803; d. London, 9 May 1874. He entered the Bengal Artillery in 1819; distinguished himself at the siege of Bhartpur, 1825–26, and took part in the Sikh War, 1848–49. At the outset of the Sepoy revolt in May 1857 he was the earliest officer to encounter the Sepoys in battle, defeating them on May 30 and 31, and succeeding to the command of the force before Delhi in July, held his position until 14 September, when the city was taken. He was rewarded for his services with a baronetcy, was promoted major-general, made lieutenant-governor in the following March, and took part in the siege and capture of Lucknow, 19 March 1858.

WILSON, Augusta Jane Evans, American novelist: b. Columbus, Ga., 8 May 1835; d. 1909. She was married to L. M. Wilson of

fessor to France. Since 1907 he has been one of the board of editors of the *American Journal of International Law*. He has published 'Town and City Government in Providence' (1889); 'Insurgency' (1900); 'Submarine Telegraph Cables in Their International Relations' (1901); 'International Law Situations' (15 vols., 1902–16); 'International Law' (1910); 'The Hague Arbitration Cases' (1915).

WILSON, Gilbert Lord, American clergyman and author: b. Centre Point, Iowa, 4 March 1856. He was educated at Cornell College and Taylor University. He is a member of various national and international societies of learning, among them being the American Association of Writers, the Society of Economic Endeavor and Research, and the National Geograpic Society; he was one of the speakers in the "Hall of Congress" at the Saint Louis Exposition. After collecting a record of eclipses coving over 3,000 years, restoring the ancient five-day, seven-day, eight-day, nine-day and 10-day week calendars of all nations, and reading the Scriptures in eight different languages, he wrote a work on the astronomy of the Bible, 'Christ in Chronology and Science of the Sabbath.' He claimed that the Sunday Seventh Day had been lost, under the 10-day week of Egypt, and restored in Moses; lost again, under the eight-day week of Rome, and restored in Christ, one "like unto Moses." He has published many writings on the Bible and science, and also on a federation "Creed of Christendom."

WILSON, Harry Leon, American novelist: b. Oregon, Ill., 1 May 1867. He has edited *Puck* from 1896, and is the author of 'Zig Zag Tales' (1896); 'The Spenders' (1902); 'The Lions of the Lord' (1902); 'Ewing's Lady' (1907); 'Bunker Bean' (1912); Ruggles of Red Gap' (1915); 'Ma Pettengill' (1919). In collaboration with Booth Tarkington (q.v.) he wrote 'The Man from Home' (1908), which passed several editions and was dramatized.

WILSON, Henry, American statesman: b. Farmington, N. H., 16 Feb. 1812; d. Washington, 22 Nov. 1875. His name was originally Jeremiah Jones Colbaith, legally changed to Henry Wilson on his reaching manhood. He was a farm apprentice in his native town till the age of 21, when he moved to Natick and learned the shoemaker's trade. After two years' work at this business he had accumulated a small sum of money, which enabled him to attend the academies at Stafford, Wolfsborough and Concord. But the loss of some of his money forced him to cut short his plan for an education, and he returned to his work at Natick in 1838, and finally built up a prosperous shoe factory. In 1840 he took an active part in the presidential campaign in behalf of the Whig party, and in the same year was elected to the lower house of the Massachusetts legislature; was re-elected to the State senate. At this time he became known as an active opponent of slavery and in 1845 was selected with J. G. Whittier (q.v.) to present to Congress the anti-slavery petition from Massachusetts against the annexation of Texas. In 1848 he withdrew from the Whig party because of its rejection of anti-slavery resolutions, and took a prominent part in organizing the Free Soil party, purchasing and editing the Boston *Republican* in the interests of that party. In 1850 and 1851 he was elected to the State senate, and was president of that body during both terms. In 1852 he was president of the Free Soil National Convention, and chairman of the national committee; and in 1853 was a member of the Massachusetts Constitutional Convention. In 1855 he was elected to the United States Senate, and shortly after taking his seat made a speech advocating the repeal of the fugitive slave law and the abolition of slavery in the District of Columbia and in the Territories. For a time in 1855 he was associated with the American party; but on its adoption of a pro-slavery platform he withdrew from it and took an active share in organizing the Republican party on the basis of opposition to the extension of slavery. In 1856 he denounced the assault of Brooks on Sumner, and was challenged to a duel by Brooks; though he refused the challenge, he stated that he believed in his right to defend himself if attacked. During the years of 1856–60 he took part in all important debates in the Senate; and his speech in defense of free labor, in reply to Senator Hammond of South Carolina, was widely circulated in the Northern States. In January 1859 he was re-elected to the Senate by an almost unanimous vote of the Massachusetts legislature; and on the assembling of the Senate in 1861, was made chairman of the committee on military affairs, a post which the Civil War rendered one of great labor and responsibility. In this capacity he introduced and carried through Congress, during the extra session of 1861, the acts to authorize the employment of 500,000 volunteers, to increase the regular army, and to reorganize the military system. In 1865 he was a third time elected to the Senate, and took a prominent part in all the reconstruction measures, favoring the granting of full civil and political rights to the negroes, but also desiring a liberal treatment of the Southern whites. In 1871 he was re-elected to the Senate but resigned in the next year when elected to the vice-presidency of the United States on the Republican ticket. In 1873 he suffered a stroke of paralysis from which he never fully recovered. At the time of his death he was engaged in writing the last volume of his 'History of the Rise and Fall of the Slave Power in America' (1873–75) which he left partially complete. He also wrote 'History of the Anti-Slavery Measures of the 37th and 38th United States Congresses' (1865); 'Military Measures of the United States Congress' (1866); 'Testimonies of American Statesmen and Jurists to the Truths of Christianity' (1867); 'History of the Reconstruction Measures of the 39th and 40th Congresses 1865–68' (1868). Consult Russell and Nason, 'Life and Public Services of Henry Wilson' (1872); Stowe, 'Men of Our Times' (1868).

WILSON, Henry Bristow, English Anglican clergyman: b. London, 1803; d. Lee, Kent, 10 Aug. 1888. He was educated at Oxford, took orders in the Church of England and was one of the four Oxford tutors who in 1841 sent a protest to the editor of *Tracts for the Times*.

sufficient size for his 13-inch globes, protracted his maps on them in sections, tapering as the degrees of longitude do from the equator to the poles and engraved them with such admirable accuracy of design, that when cut apart and duly pasted on his spheres the edges with their lines and even the different parts of the finest letters would perfectly coincide and make one surface, truly representing the earth or celestial constellations. He published his first globes in 1814. When past 80 he constructed a machine which illustrated the daily and yearly revolutions of the earth; the cause of the successive seasons; and the sun's place for every day of the year, in the ecliptic. These movements were produced by turning a crank, which caused the earth to revolve about the sun in the plane of the ecliptic, always retaining its true relative position. For want of a more definite name the machine was called Wilson's Planetarium. The large copper plate, on which are printed the months of the year, with their days and the corresponding signs of the zodiac with their degrees, was engraved by Wilson after he was 83 years of age.

WILSON, James, American politician: b. Ayreshire, Scotland, 16 Aug. 1835. He came with his parents to the United States in 1851, and settled in Iowa in 1855. He was educated at Iowa College, engaged in farming in 1861 and in that year was elected to the State legislature, where he served for three terms, acting as speaker for the last term. He was a member of Congress in 1873–77, State railway commissioner in 1877–83, and in 1883–85 was again a member of Congress. He was a regent of the State University in 1870–74 and in 1890–97 was director of the agricultural experiment station and professor of agriculture at the Iowa Agricultural College, Ames, Iowa. He was appointed Secretary of Agriculture by President McKinley in 1897, was reappointed in 1901 and retained in office by both President Roosevelt and President Taft, serving for a period of 16 years. During this time the Department of Agriculture developed rapidly; forest reserves were made; experiment stations were established; and farm demonstration work carried on on a national scale. Consult 'Year Book of the Department of Agriculture for 1912' (Washington 1913).

WILSON, James F., American politician: b. Newark, Ohio, 19 Oct. 1828; d. Fairfield, Iowa, *22* April 1895. He studied law, settled at Fairfield, Iowa, in 1853, was elected to the convention for a revision of the State constitution in 1856, sat in both houses of the State legislature and was president of the senate in 1861. From 1861 to 1869 he was a member of Congress, where he was chairman of the judiciary committee and one of the managers of the impeachment of Andrew Johnson. In 1883 he was elected to the United States Senate and in 1889 re-elected. He was made a commissioner for the Pacific Railway.

WILSON, James Grant, American author: b. Edinburgh, Scotland, 28 April 1832; d. 1914. He was brought to America in infancy by his father, William Wilson (q.v.), served in the Union army during the Civil War and reached the rank of brigadier-general. After the war he settled in New York and in 1885 became president of the New York Genealogical and Biographical Society. Among his numerous publications are 'Biographical Sketches of Illinois Officers' (1862–63); 'Love in Letters, Illustrated in the Correspondence of Eminent Persons' (1867); 'Life of Fitz-Greene Halleck' (1869); 'Sketches of Illustrious Soldiers' (1874); 'Poets and Poetry of Scotland' (1876); 'Centennial History of the Diocese of New York, 1775–1885' (1886); 'Bryant and His Friends' (1886); 'Commodore Isaac Hull and the Frigate Constitution' (1889); 'Life of General Grant' (1897); 'The Presidents of the United States' (1901); 'Thackeray in the United States' (2 vols., 1904). He was the editor (with John Fiske) of 'Appleton's Cyclopædia of American Biography' (6 vols., 1887–89; Vol. VII, 1900), and alone, of 'Memorial History of the City of New York' (1892–93).

WILSON, James Harrison, American soldier: b. Shawneetown, Ill., 2 Sept. 1837. He was graduated from West Point in 1860, was promoted lieutenant in 1861 and was chief topographical engineer on the Port Royal expedition. He was brevetted major 11 April 1862 for conduct at Fort Pulaski, Ga., and subsequently was aide-de-camp to General McClellan, participating in the battles of Antietam and South Mountain. In the campaign against Richmond and in the operations against Chattanooga and Knoxville he was assistant engineer and inspector-general of the Army of Tennessee, and in 1863 was made brigadier-general of volunteers and brevet lieutenant-colonel of regulars for gallantry at Chattanooga. He was brevetted colonel for conduct at the battle of the Wilderness and was engaged in the siege of Petersburg and in the Shenandoah campaign. In September 1864 he was transferred to the command of the cavalry of the Mississippi Division, took part in General Thomas' campaign in Tennessee and was conspicuous at the battles of Franklin and Nashville. In March 1865 he made a raid into Alabama and Georgia and in 28 days captured Selma, Montgomery, Columbus and Macon, taking 6,820 prisoners, among whom was Jefferson Davis. He received brevet rank as brigadier- and major-general and in 1866 was mustered out of the volunteer service. He was appointed lieutenant-colonel in the regular army in that year, but resigned in 1870 and was subsequently engaged in railroad engineering until the outbreak of the Spanish-American war when he was appointed major-general of volunteers and was assigned to command a division in Porto Rico. In 1900 he joined the China relief expedition and was commander of the American forces in Peking. He was retired with the rank of brigadier-general of the United States army in 1901. In 1902 he represented the United States army at the coronation of Edward VII. He has published 'Life of Andrew Alexander' (1868); 'Life of General Grant' (with Charles A. Dana, 1868); 'China — Travels and Investigations in the Middle Kingdom' (1887, new ed., 1890); 'Life of Charles A. Dana' (1907); 'Under the Old Flag' (1912).

WILSON, Jeremiah Morrow, American jurist: b. Warren County, Ohio, 25 Nov. 1828; d. Washington, D. C., 24 Sept. 1901. He received an academic education; was judge of the Court of Common Pleas of Fayette County, Ind., 1860–65; judge of the Circuit Court 1865–71 and 1 member of Congress in 1871–75. After

retiring from Congress he took up the practice of law in Washington, D. C., and during his professional career in that city was connected with numerous famous cases. Besides having acted as attorney for the Union Pacific Railroad and the Mormon Church, he was counsel in the court-martial of General Swain and was connected with the "Alabama Claims" and the French "Spoliation" cases; etc.

WILSON, John, American colonial clergyman: b. Windsor, England, 1588; d. Boston, Mass., 7 Aug. 1667. He was educated at King's College, Cambridge, in 1606; was made Fellow there; studied law, but took orders; was minister of Sudbury, Suffolk; and having frequently been suspended as a Puritan, embarked with John Winthrop for America in 1630 and landed at Salem, Mass. At Charlestown he organized what afterward became the First Church of Boston, of which he was ordained pastor in 1632. He visited England in 1634, returning the following year with his wife and also Hugh Peters (q.v.). He was opposed to the so-called "antinomian heresy" of the time; was associated with John Eliot (q.v.) in missionary work among the Indians; and was chaplain to the force sent against the Pequots of Connecticut. He published 'Some Helps to Faith' (1625); a poem, 'Famous Deliverances of the English Nation' (1626); a Latin poem commemorating John Harvard; and 'The Day Breaking, If Not the Sun Rising, of the Gospel' (1647; new ed. 1865). He had, says Cotton Mather, "so nimble a faculty of putting his devout thoughts into verse, that he signalized himself by . . . sending poems to all persons, in all places, on all occasions."

WILSON, John, Scottish author, best known by his pseudonym "CHRISTOPHER NORTH"; b. Paisley, 18 May 1785; d. Edinburgh, 3 April 1854. He was educated at Glasgow University and Magdalen College, Oxford, and while at Oxford was noted for his skill in boating, cricketing and other athletic sports. Having at 21 come into a large fortune, he purchased the property of Elleray, on Windermere, and retired there to live at his ease, writing poetry. Here he became closely associated with Wordsworth, Southey, De Quincey and Coleridge. In 1812 he wrote the once-famed 'Isle of Palms.' Another poem in dramatic form, 'The City of the Plague' (1816), was still more successful; but is now forgotten. At this time Wilson suffered reverses of fortune through fraudulent speculation of an uncle and it became necessary for him to earn his livelihood. In 1817 he went to Edinburgh and together with J. G. Lockhart (q.v.), became connected with *Blackwood's Magazine*. His fame with posterity rests on his prose writings and more especially his contributions to this famed Tory organ. Among the numerous papers furnished by Wilson may be mentioned those celebrated ones on fishing, shooting and kindred pursuits produced under the well-known sobriquet of "Christopher North" and above all his renowned 'Noctes Ambrosianæ,' a series of conversations on literary and general subjects, supposed to take place at certain convivial meetings held in Ambrose's Tavern by the contributors to the *Magazine* and since reprinted separately. In 1820 he obtained the chair of moral philosophy in the University of Edinburgh, a post he occupied with credit for 31 years. In 1822 to 1824 he published three prose works of fiction, 'Lights and Shadows of Scottish Life'; 'The Foresters'; and 'The Trials of Margaret Lyndsay,' which are marked by pathos and beauty of description, but are far from being faithful transcripts of human nature, and degenerate at times into mawkish sentimentality. He resigned his professorship in 1851, and a government pension of £300 per annum was bestowed upon him. There is an incomplete edition of his works by Ferrier (12 vols., 1855–58), and a separate edition of the 'Noctes' by R. S. Mackenzie (5 vols., 1866). Consult 'Memoir' by his daughter, Mrs. Gordon (2 vols., Edinburgh 1862); Saintsbury, 'Essays in English Literature' (London 1890); Mrs. Oliphant, 'William Blackwood and His Sons' (1897); Douglas, 'The Blackwood Group' (1897); Winchester, C. T., "John Wilson" (in 'Group of English Essayists of the Early Nineteenth Century,' New York 1910).

WILSON, John, Scottish missionary: b. Lauder, Scotland, 11 Dec. 1804; d. Bombay, India, 1 Dec. 1875. He was educated at the University of Edinburgh, went to Bombay in the service of the Scottish Missionary Society in 1828, and in 1835 transferred his labors to the mission work of the Free Church of Scotland. He established numerous schools; became vice-chancellor of the University of Bombay; contributed largely to the abolition of the practice of suttee; traveled all over India establishing missionary centres; and was universally honored and beloved by the natives, among whom he spent the remainder of his life with the exception of the years 1843–47. He founded in 1830 the *Oriental Christian Spectator* issued for 30 years, and was the pioneer of Christian periodicals in India. His linguistic ability was remarkable, and his contributions to literature included 'The Parsi Religion' (1843); 'India Three Thousand Years Ago' (1858); 'Memoirs on the Cave-Temples of India' (1859); 'The Lands of the Bible Visited and Described' (1867); and 'Indian Caste' (1877). Consult Smith, George, 'Life of Wilson' (1878).

WILSON, John Mackay, Scottish author: b. Tweedmouth 1804; d. Berwick-on-Tweed, 2 Oct. 1835. He edited for several years the *Berwick Advertiser* and was editor and principal author of the popular 'Tales of the Borders' (1835–40). The latest edition, revised and enlarged to 24 volumes, appeared in 1869.

WILSON, John Moulder, American military engineer: b. District of Columbia, 8 Oct. 1837. He was graduated from West Point in 1860, received rank as lieutenant in 1861 and subsequently served in the Manassas, Peninsular and Maryland campaigns. He was conspicuous for gallantry at Gaines's Mills and at Malvern Hill in 1862 and in 1863 was promoted captain, subsequently serving in the engineer corps. In 1865 he was brevetted colonel of volunteers and both lieutenant-colonel and colonel of regulars for gallantry at the capture of Spanish Fort in Mobile Harbor and at Fort Blakely. After the war he was in charge of various important engineering works under the government and in 1885–89 was superintendent

of public buildings and grounds in the District of Columbia. He directed the completion of the Washington Monument, the construction of the Army Medical Museum and Library and other public buildings and memorials. He was appointed superintendent of the Naval Academy in 1889; in 1897 was appointed chief of engineers with rank of brigadier-general and was retired at his own request in 1901.

WILSON, Luther Barton, American clergyman: b. Baltimore, Md., 14 Nov. 1856. He was graduated from Dickinson College 1875, and also from the University of Maryland Medical College, M.D., 1877. He entered the ministry of the Methodist Episcopal Church, joining the Baltimore Conference in 1878. After several successful pastorates and two terms as presiding elder in Washington and Baltimore, he was elected bishop in 1904. He was Fraternal delegate to the Methodist Church of Canada in 1902. He was one of the chief founders of the Anti-Saloon League of America and one of its first vice-presidents, and when Hiram W. Price of Iowa, the first president, died Bishop Wilson became president and continues to serve in that office. He is a trustee of several institutions and societies and had been for some years president of the board of trustees of Drew Theological Seminary. During the European War he was active in promoting the welfare of the soldier — visiting the firing line in France and Italy several times. He has written 'The Moslem Menace' (1912); with H. H. Meyer and L. H. Hough, 'Marshalling the Forces of Patriotism' (1918); 'America Here and Over There' (1918).

WILSON, Richard, Welsh landscape-painter: b. Penegoes, Montgomeryshire, 1714; d. Llanberis, Carnarvonshire, May 1782. He went to London and studied portrait-painting with Thomas Wright. He was somewhat successful in London, but at length went to Italy where he met Zuccarelli, the artist, who persuaded him to devote himself wholly to landscape. After staying some time at Rome and Naples, where he acquired great reputation, he returned to England in 1755 and settled in the metropolis. He had for a while much employment; but was at length doomed to undergo indifference and neglect, and was glad to obtain the office of librarian to the Royal Academy in 1776. His taste was exquisite and whatever came from his easel bore the stamp of elegance and truth. Among his best works are the 'Niobe,' 'Ruins of the Villa of Mæcenas,' 'Phæthon,' 'Snowdon,' 'View of Rome from the Villa Madama.' Three of his works are to be seen in the New York Metropolitan Museum. Consult Hastings, Thomas, 'Etchings from the Works of Richard Wilson, with some Memoirs of his Life' (London 1825); Wright, T., 'Some Account of the Life of Richard Wilson' (London 1824).

WILSON, Sir Robert Thomas, English soldier and author: b. London, 17 Aug. 1777; d. there, 9 May 1849. He was educated at the Westminster and Winchester schools, volunteered for the war in Flanders in 1793–94, and was a member of the staff during the Irish rebellion of 1798. He served in Holland in 1799 and in 1800 was engaged under Abercrombie in Egypt. He served under Lord Hutchinson on a secret mission to the allied armies on the Russian frontier in 1806–07, and in 1808–10 commanded a Lusitanian legion and later a Spanish brigade in Spain and Portugal. He sat in Parliament for Southwark in 1818–31 and for his espousal of the cause of Queen Caroline he was dismissed from the army in 1821 but subsequently reinstated. He received promotion to full rank as general in 1841 and in 1842–49 was governor of Gilbraltar. He was author of several works on military subjects, several of which were not published until after his death, when they were edited by his son-in-law, Rev. Herbert Randolph. They include 'History of the British Expedition to Egypt' (1802); 'Sketches of the Campaigns in Poland' (1810); 'Military and Political Power of Russia' (1817); 'Narrative of Events During the Invasion of Russia' (1860); 'Diary' (1861), etc. Consult Randolph, 'Life of Gen. Sir Robert Thomas Wilson' (1863).

WILSON, Rufus Rockwell, American author: b. Troy, Pa., 14 March 1865. He was engaged in journalism in Pittsburgh, Washington and New York in 1883–91; in 1891–1906 he became known as magazine writer and newspaper editor, also for a time being manager of a newspaper syndicate; he entered political reform work in 1910, and the following year organized and superintended certain Chinese famine relief work. He has published 'Rambles in Colonial Byways' (1900); 'Washington — The Capital City' (1901); 'New York, Old and New' (1902); 'Lincoln in Caricature' (1903); 'The Sea Rovers' (1906); 'A Noble Company of Adventurers' (1908); 'Literary Landmarks of America' (1915).

WILSON, Theodore Delevan, American naval constructor: b. Brooklyn, N. Y., 11 May 1840; d. Boston, Mass., 29 June 1896. He served an apprenticeship in the Brooklyn navy yard and in 1861 was appointed a carpenter in the construction department of the navy. In 1866 he was appointed assistant naval constructor; subsequently he was engaged in the navy yards at Pensacola, Philadelphia and Washington. In 1869–73 he was instructor in naval architecture and shipbuilding at the Naval Academy, Annapolis, Md., and in the last-mentioned year was promoted to be naval constructor. He was chief constructor of the navy from 1882–93, when he resigned because of failing health, and was granted a two years' leave of absence, resuming his duties at the Boston navy yard in 1895. He was an honorary member of the Institute of Naval Architects of England, the first American to be elected to that body. He patented in 1870 the "air-ports," since generally adopted in the navy and in merchant-ships, and in 1880 patented a bolt extractor which has since come into general use. During his service he designed the battleship *Maine*, the cruisers *Boston*, *Chicago* and *San Francisco*, the gunboats *Concord*, *Bennington*, *Petrel* and other vessels. He wrote 'Shipbuilding, Theoretical and Practical' (1873), which was adopted as a textbook at the Naval Academy.

WILSON, Thomas, English Anglican prelate: b. Burton, England, 20 Sept. 1663; d. Isle of Man, 7 March 1755. He was educated at Trinity College, Dublin, and was curate of

where he was a professor in the Presbyterian Theological Seminary. Woodrow experienced some of the terrors of the Civil War when the people of the town of Augusta daily expected a visit from Sherman's army, and again in Columbia where a large part of the city remained a burnt-over area till the Wilson's moved away to Wilmington, N. C., in 1875. Woodrow's early training was received in private schools in Augusta and Columbia, and from his father and grandfather, Dr. Thomas Woodrow, of Columbus, Ohio, the latter being a devotee of the ancient classics and frequently in the Wilson home. From this Presbyterian home, Woodrow went to Davidson College, North Carolina, a staunch Presbyterian college, in the autumn of 1874, where he remained a year. But in the autumn of 1875 he went to Princeton where the father had studied theology and where the great Presbyterian leaders of the country were wont to live and teach.

At Princeton, Wilson took rank as a leader among his fellows, attained a fair standing in his class, but made it plain to all that wide reading and close study of public affairs were his chief interests. He and his family were already close observers of British politics, Gladstone being a hero in their circle. Wilson showed this interest in a remarkable article published, while he was still an undergraduate, in the *International Review*, in which the germ of his first book was uncovered. He was graduated in 1879 and the next year went to the University of Virginia to study law. There he took a law degree in 1881 and early in 1882 settled in Atlanta to practise his profession. There he probably did not make his mark as a lawyer; but he continued his study of government and politics, as illustrated in the workings of Congress. True to his bent, he abandoned the law and entered Johns Hopkins University in 1883 where he wrote his first book, 'Congressional Government,' published in 1885. The same autumn he began teaching history and political economy in Bryn Mawr College and the next year, somewhat against his wishes, he took his examinations at Johns Hopkins and was awarded the degree of doctor of philosophy, then so highly prized among college teachers everywhere. In 1888 he went to Wesleyan University, Middletown, Conn., as professor of history and political economy. There he gained a grip upon student life and opinion that marked all his later educational career. But the popularity of 'Congressional Government' and the importance of its criticism of American governmental practices were making him a national and even international reputation. At Wesleyan he wrote a review of Bryce's 'American Commonwealth,' which brought him into close friendly relations with that eminent Englishman. In this review one sees the reflection of a keen historical mind and independent thinker.

In 1890 Wilson was called to Princeton as professor of jurisprudence and political economy, which position he held till 1910 when he ceased his connection with the university to become governor of New Jersey. As professor at Princeton, he practically founded the department of political science, as it is now taught in all American universities. His power over students, his activity as a leader in the rapid development of the college into a university, his many articles in periodicals, his lectures in various parts of the country and his books raised him to the foremost position in the faculty and when President Patton resigned in 1902, he was chosen to head the university. He at once set about far-reaching reforms. American college and university students, reflecting the growing riches of their parents, had already become loiterers at their work. Wilson endeavored to compel them to study. Instead of increasing the number of students at Princeton, he pressed so closely his requirements that scores, even hundreds, of young men were sent away each year because they failed in their examinations. Some witty undergraduate is reported to have said that if Dr. Wilson kept on he would make Princeton an educational institution. But the necessity of passing the examinations was not all. Wilson introduced what has been called the preceptorial system at Princeton. By this method every student was brought into close relations with a teacher who made it his business to lead a small group of young men in their work and introduce them to the world of books. The new system cost a great deal of money and Wilson endeavored to collect it. His activity in that direction brought him into closer touch with Princeton men all over the country and he became very popular. His next reform was of a similar nature. There had grown up at Princeton an elaborate club system which was more important to most of the undergraduates than the passing of examinations. To become a member of one of the clubs was the first ambition of most students. Moreover the social life of the students was absorbed by these clubs. Wilson proposed in 1907 that as soon as suitable dormitories could be provided, all students should live together and have their rooms assigned to them by lot; that they should eat together, the rich and the poor, in dining-places on or near the quadrangle; and that the unmarried tutors should live with the students in the dormitories. This reform was aimed at making student life democratic and helpful to all alike. This, too, would cost large sums of money and require several years to become effective. It was, however, too much for the students. Some professors also found the new pace a little too swift and the alumni encouraged resistance.

But before the resistance became effective, a gift to the proposed graduate school, which all held as necessary to the very existence of the university, introduced a new subject of discussion. Dean Andrew West, a close friend of the president, desired the graduate school to be set up at a distance from the quadrangle which Wilson would make the centre of college life. Wilson objected gently. The matter remained in abeyance till in 1909 a conditional gift of something like a million dollars to the graduate school compelled a decision. The gift was to be applied according to the wishes of Dean West. Wilson refused to accept it on those conditions. The segregation of the graduate students seemed to him to thwart the democratic purposes of his whole reform program. The trustees sided with Wilson and the gift was formally declined, but not before the subject had become a national one, for the newspapers of the country discussed the issue. In May 1910, Isaac Wyman of Boston died and left

a legacy, reported to be several millions, to the graduate school. Dean West was to be one of the executors of the will and he was to use the new millions to carry out his ideals in the new school. Wilson could not refuse these millions. And, before this time, the opposition to his quadrangle reforms had assumed formidable proportions. Dean West's influence and that of the students and professors who opposed the president were united. The Wilson reforms, popular as they were in educational circles throughout the country, were halted. It was commonly rumored that Wilson would resign at commencement 1910.

This work at Princeton had made Wilson widely known in the United States as an educator. Before it took its final turn in 1910, Col. George Harvey, representing the conservative wing of the Democratic party and editor of *Harper's Weekly*, inaugurated a movement to bring about Wilson's nomination for President by the Democratic party in 1912. Harvey enlisted newspaper editors and political party leaders of the type of James Smith, Jr., of New Jersey in the cause. The country was growing restless at the conduct of the Republican party. Wilson was a progressive Democrat; Harvey and his friends were reactionary Democrats. The presidential election was then two years off and the situation in the Democratic party was one of great uncertainty. The efforts of Wilson's friends, however, had resulted in making him a prominent political figure and there arose a popular demand in his home State for his nomination as a candidate for governor. His nomination followed in September 1910, and in October the presidency of Princeton was given up. The campaign that Wilson conducted that autumn in a stalwart Republican State attracted the attention of the country. The election of Wilson by a majority of 49,000 made him a real candidate for the Presidency which his administration as governor further advanced. He could not fulfil the hopes of the conservative Democrats as governor and broke with Smith. Later he broke with Harvey. When the conservatives abandoned him and endeavored to give all their influence to other candidates for the Democratic Presidential nomination, the more progressive elements of the Democratic party turned to Wilson. Of greater moment was the break-up of the Republican party in June 1912. Colonel Roosevelt endeavored to prevent the renomination of his former friend, Taft, and, failing to do so, led a revolt from the convention. It was plain that a new convention, composed of the Roosevelt men, already announced in Chicago, would nominate the colonel. These events focussed the national attention upon the Democratic party when it assembled in convention at Baltimore 25 June 1912. No such convention had ever been held in American political history. It lasted until 2 July and was marked from the beginning by intense bitterness between the conservative and progressive elements of the party. In addition to Mr. Wilson the leading candidates were Speaker Champ Clark of Missouri, Judson Harmon of Ohio and Oscar W. Underwood of Alabama. Mr. Wilson won on the 46th ballot, largely through the support thrown to him by William Jennings Bryan.

Wilson made an active campaign and was elected by a vote of 435 in the electoral colleges against 88 for Colonel Roosevelt and eight for Mr. Taft, the regular Republican candidate. The popular vote for Wilson, however, totaled only 6,293,019 as against 7,604,463 votes cast for Roosevelt and Taft. But the Democrats won large majorities in both houses of Congress and Wilson entered the Presidency in March 1913, with every branch of the government at his command. He summoned Congress in extra session in April. All the great committees were headed by Democrats, if not by his friends. He urged at once some of the greatest reforms that have ever been effected in the history of the country. Acting on his recommendations Congress reduced the tariff from a general level of 45 to 25 per cent and greatly enlarged the free list. Many economists alleged that for the first time in half a century the tariff was written in the interest of the masses and not in that of the manufacturers. Of even greater importance was the reform of the national currency system in the Federal Reserve Act of 1913, by which the control of the money of the country was taken from private hands and placed in the Treasury Department. The country was divided into 12 banking districts and the reserves of those districts were placed in certain reserve cities in order that the needs of the country as a whole might the better be served and what had been called financial panics, produced by the nervous financial state of mind of New York, the reserve centre under the old system, might be averted. This measure was immediately successful. These reforms of 1913 were followed by the Clayton Anti-trust and the Federal Income Tax laws of 1914, the former of which definitely settled an old issue, while the latter subjected the incomes of the country to a graduated tax that quickly proved to be of revolutionary character.

Although the Democratic party was not in entire accord with Wilson, and the Republicans as a whole resisted him with all their might, he held Congress in session almost continuously till the great European War brought another series of problems before the country. But already the Wilson foreign policy was shown in his refusal to allow the army and navy to be used on behalf of money lenders or investors in Mexico and South America. He even went so far as to say at Mobile, in October 1913, that the United States would never again annex a foot of land against the will of those most concerned. This attitude bewildered European diplomats and it angered important elements in the United States. Wilson had an excellent opportunity to illustrate his foreign policy in Mexico where General Huerta rose to the presidency through the assassination of Madero early in 1913. Huerta was favorably disposed toward American investors in Mexico. Wilson refused to recognize Huerta and by his attitude compelled the overthrow of that leader, only to find that the two Mexican generals who had together fought Diaz and Huerta now fell to fighting each other. Wilson gave his support to Carranza, but the months and years that passed did not suffice to pacify the distracted country; and in 1916 Wilson was compelled to send expeditions into the country to compel respect for American law and international rights. The Mexican difficulty, however, soon paled into insignificance in comparison with the difficulties produced by the European War

which began on 1 Aug. 1914. While the President was preparing for his first taking of the sense of the country on the policies he had put into practice, this great upheaval set men's thoughts upon other subjects. The election of 1914 resulted in a return to Congress of a majority of Democrats, most of whom were pledged to support the administration.

Meanwhile, on 18 August, Wilson declared in a proclamation to the country that all men must maintain a strict neutrality as between the warring powers. Leading public men and newspapers, regardless of party alignments, gave him hearty support; but as the war continued and cast its shadow over the whole world, the different elements of the composite country took sides. A particular source of irritation was occasioned by German propagandists who did their utmost to break the country's neutrality; others of the same group tried to affect the course of the war by attempting the destruction of bridges and canals and by inciting strikes in munition plants from which the Allies derived a considerable portion of their supplies. Wilson took every possible occasion to press upon the country the necessity of national unity, of devotion to the ideals for which the United States had been established and of refraining from deeds that might commit the country to either side. He went so far even as to say that "there was such a thing as being too proud to fight." He endeavored to bring about peace in Europe by the offer of his services as a mediator. On 7 May 1915, a German submarine commander deliberately sunk the great British liner, the *Lusitania*, sending 1,154 persons to their death, of whom 114 were American citizens. The country was intensely excited; but Wilson felt that he could not then go to war. He demanded apology and reparation and gave Germany solemn warning. Other ships were sunk during the year and other American lives were lost; but confronted with a national election in 1916, neither Wilson nor the Republican national convention of that year proposed war as a remedy. Nor did the Progressive convention, which Colonel Roosevelt dominated, suggest war. The leaders did not know what the people thought. The Republicans finally nominated Mr. Justice Hughes as their candidate and the Progressives confirmed him as their choice. The platforms dealt with domestic problems insisting on foreign affairs only in the commercial rights of the country.

Wilson was renominated. The Democratic platform simply approved the Wilson policies and asked that he be returned to office on the ground that as President he had kept the country out of war. Wilson was re-elected, his plurality reaching 581,941 votes. Yet so close was the contest in the Electoral College that a reversal of 2,000 votes in California would have made Mr. Hughes President. During the campaign Wilson had said that the rôle of neutrality had been about played out. The President's attitude at this time toward the struggle in Europe is best gathered from his address at Omaha on 5 Oct. 1916, in which he said: "It will take the long enquiry of history to explain this war, but Europe ought not to misunderstand us. We are holding off not because we do not feel concerned, but because when we exert the force of this nation we want to know what we are exerting it for. . . . We want to know whenever we act what the purpose is — what the ultimate goal is." In the request for the passage of the so-called Adamson law, of the preceding September, he had asked for the extension of the United States eight-hour law to include workers in the railroad trains service. A great strike was averted. He was about to make one more effort to bring the European war to an end, when Germany on 12 December asked for a conference of the warring powers for the purpose of securing peace. Germany did not disclose her conditions. Wilson submitted the German proposal to the Allied powers. The reply was a quick refusal. On 22 Jan. 1917, Wilson spoke to the Senate in what was at once called a remarkable address. The principal ideas that later became famous in the Fourteen Points were now suggested to Europe as a basis of peace. He even said that a lasting peace could only be secured by a "peace without victory." He meant that the bitterness of a war to the "last man" ought to be avoided.

His effort failed. On the last day of January the German Ambassador in Washington handed the government a note in which the German government announced its intention to declare a submarine blockade about England, France and Italy and warned all nations to beware on penalty of having their ships and their people sunk without notice. Wilson's reply was to dismiss the German Ambassador and request Congress to declare the country in a state of armed neutrality. Congress failed to grant the request and Wilson set about preparing for American entrance into the conflict. When the regular session of that Congress came to an end, he promptly summoned the new Congress in extra session for 2 April "to receive a communication concerning grave matters of national policy." On 2 April he addressed Congress in a great speech recommending that Congress declare "the recent course of the Imperial German government to be in fact nothing less than war against the government and people of the United States." On 6 April war was declared by large majorities. But Wilson took pains to insist to the country and all the world that the United States did not go to war for any material interests or any imperialistic purposes of any of the powers concerned. It was to be a war to "make the world safe for democracy." He endeavored to convince the people of the United States that annexations and commercial exploitation were the natural causes of war; and he sought to impress Europe with the idea that democracy was the only safe rule for governments and that absolute equality among all peoples, great and small, was the only safe rule of international conduct. From 2 April 1917 to 11 Nov. 1918, Wilson's career is in great part world history; he swayed the whole world as no other statesman had ever swayed it. An English Liberal has said that "it was like the voice of God talking over our heads to the continent and to the nations of the world." The sum of it all was expressed on 8 Jan. 1918, in the marvelous address in which the Fourteen Points, now so well known to the world, were laid down. He wished to commit all men to the freedom of the seas, the self-determination of peoples, open diplomacy, the

freest possible trade among nations, access of inland nations to harbors, disarmament everywhere and a League of Nations that should lead and guide mankind into better ways. Upon such a basis would the United States conclude peace. From public statements of European leaders and from the avowals of responsible diplomats, these points were accepted, although thoughtful men everywhere doubted whether, at the end, the greater European powers would actually abide by such a program of self-denial.

There was a strenuous protest in the industrial centres of the United States against the possibility of free trade. Colonel Roosevelt denied in a vigorous campaign in the autumn of 1917 that the United States fought to make the world safe for democracy. In January 1918 he and many other prominent leaders, both Democratic and Republican, tried to press through Congress a bill which would have set up a war cabinet to assist the President. Wilson opposed the movement and it failed. But the fight upon the President and his war platform was continued till the Congressional election of 1918. Wilson asked the country in a formal statement to return Democrats to Congress in order that he might the better carry the war to a conclusion. It was a close election in which the Republicans won a majority in the Senate by two votes and in the House by a larger margin. Much money was spent in the campaign and one of the senators was still defending himself in court, late in 1919, against the charge of corrupt use of money. It was the first time that Wilson was confronted with the prospect of a hostile Congress, a fact which appeared the more significant as the near approach of a breakdown of Germany and her allies became known. When an armistice was proposed by Germany, the Allied governments agreed that Wilson should be the common spokesman; but Colonel Roosevelt and Senator Lodge gave out a statement of Republican conditions of peace which were supposed to be more hostile to Germany than Wilson's Fourteen Points. The Republicans announced that they were unwilling to allow Wilson to represent the country in the peace conference.

In his annual message of December 1918, Wilson announced that he would go in person to Paris to aid in the negotiation of a world peace. The leaders of the Senate warned him against this course and many of the greatest papers in the North took the view that it was inexpedient it not improper and unconstitutional for the President to attend the peace conference in person. A former senator and a former attorney-general of the United States gave it as their matured opinions that Wilson would cease to be President the moment his ship passed beyond the boundary of the country. Nevertheless Wilson sailed for Europe on 4 December, and arrived in Paris on the 14th. He received an ovation that surpassed anything witnessd in France since the days of Napoleon I. In London a similar demonstration was made when he arrived there just after Christmas. Early in January he visited Rome where he was counted as a sort of messiah, come to save Europe from the terrors of future wars. These visits were made at the request of the governments concerned and during the delays incident to the gathering of the peace conference. Still, he was not unaware of the risks of his position. He had remarked to a friend in September preceding that he almost dreaded to think of the end of the war, for then every nation of Europe and every group of interests in the United States would begin to think of selfish ends.

When the peace conference opened, it was promptly discovered that the first of the Fourteen Points, open covenants openly arrived at, could not be realized. Men simply would not discuss in public the graver issues involved, lest the very ends they sought should be jeopardized. The conference decided to sit behind closed doors. Then it was found that the conference was too large for rapid work and a council of five, including Wilson, Lloyd George, Clemenceau, Orlando of Italy and Makino of Japan took its place. This was later changed to a council of four, the Japanese representative simply absenting himself. Wilson labored a month to induce his colleagues to accept the Fourteen Points, including the proposed league of nations, the most important of all. The other representatives endeavored for a month to arrange the preliminaries of a peace without applying the Wilson principles and without accepting the league idea. But unable to agree, the whole conference met on the 14th of February and accepted the idea of a league as a part of the treaty. Wilson returned to America and in public addresses warned his opponents that the covenant of the League of Nations would be so interwoven with the Treaty of Peace that the rejection of the former would involve the rejection of the latter. How little this statement availed its author was revealed in the months that followed.

Returning to Paris about the middle of March 1919, Wilson found the conference had abandoned the League of Nations idea and had set about a peace of indemnities, annexations and reprisals. For a month Wilson fought almost single-handed for a peace which he could call democratic. He won to the extent that France abandoned her demand for a Rhine frontier and agreed to self-determination in Poland and other European submerged nationalities; and the League of Nations was made a part of the treaty. But the concessions greatly weakened the President, while the opposition to him on substantially imperialistic grounds gained constantly in the United States. Wilson returned with the Treaty and, calling Congress together, laid it before the Senate on 10 July 1919. Immediately the bitterest opposition was manifest. Wilson fought for his work at Paris. He recognized that the essentials of his whole career in the White House were under attack. He made a tour of the country on behalf of the adoption of the Treaty and the League of Nations. He spoke at Columbus, Ohio, at Saint Louis, at many other points in the Middle West and on the Pacific Coast. Everywhere he urged acceptance of the Treaty and at many places received extraordinary ovations. But he was taken ill at Wichita, Kans., and was hurried home to Washington, where he was kept in bed for several months. The judgment of history upon his contribution to the progress of "all men everywhere," as the American ideal

Miss., 150 miles southwest of Eastport, while Roddey's forces occupied Montevallo, on the Alabama and Tennessee Railroad, nearly the same distance to the southeast. By starting on diverging roads the enemy was left in doubt as to the real object and compelled to watch equally Columbus, Tuscaloosa and Selma. Therefore the divisions marched on different roads, but the objective point of each was Selma, distant 180 miles, and the average march of each division to reach it was 250 miles. The command moved southward in three columns and on the 26th reunited at Jasper, about 80 miles southeast of Tuscumbia, from which it crossed the two forks of the Black Warrior, and pushed for Montevallo, a centre of iron manufacture. General Croxton's brigade was detached to move on Tuscaloosa, to burn bridges, factories and public stores, and rejoin the command in the vicinity of Selma. Ironworks and rolling mills were destroyed near Elyton, and 31 March, after passing Montevallo a mile, Upton encountered Roddey, who disputed the road to Randolph. After two brisk engagements Roddey was driven back, losing 100 men, and was pursued by Upton, who occupied Randolph at dark. Here a courier was captured with dispatches to Forrest, showing that several columns were moving to join Forrest for the defense of Selma, and detachments were sent to check them. McCook was left at Randolph to guard the trains and rear, while Wilson, with the divisions of Long and Upton, on 1 April, rode straight for Selma, encountered and brushed away several detachments of Forrest's cavalry and at Ebenezer Church came upon Forrest in position, with the brigades of Roddey, Crossland and D. Adams, about 1,500 men, covering the two roads from Randolph by which Wilson had marched. Long's division and Alexander's brigade of Upton's attacked and carried the position in less than an hour, the Confederates retreating in great disorder toward Selma despite all of Forrest's efforts to rally them. At night the whole command bivouacked about Plantersville, 19 miles from Selma, after almost constant fighting during the day of 24 miles, during which Wilson had captured three guns and over 200 prisoners. Early in the day McCook, with Colonel La Grange's brigade, had been ordered to march rapidly to Centreville, 40 miles distant, to seize and hold the bridge over the Cahaba, and to fall upon Jackson's Confederate cavalry division, which had thrust itself between the main body and Croxton. At daylight, 2 April, Wilson resumed his march and by rapid movement, without opposition, the troops were in sight of Selma and mostly in position by 4 P.M. The city had been sufficiently fortified, as was believed, against any possible cavalry attack. The works contained 24 bastions and a number of strong redans, with deep ditches and an interior line of four detached forts. They were of semi-circular form, nearly three miles in extent, with both flanks resting on the Alabama River, above and below the city. They mounted 32 guns and were held by Forrest, with about 4,000 veteran cavalry and some 2,000 Alabama militia, home guards and citizens, mostly old men and young boys. Wilson had obtained accurate plans of the works and of the ground in front of them. During the day these sketches were shown to all his general officers and the plan of attack explained, from which it resulted that upon reaching the vicinity of the works, the various brigades went quickly into position, with great precision. At a given signal Long's division was to lead in the assault, supported by Upton, but before the signal had been given Long had become engaged and without waiting he ordered the charge, and in the gathering darkness his men went forward, under a severe fire of artillery and musketry, scaled the works and after a hand-to-hand encounter drove the Confederates from them and took many prisoners. Some of Upton's men joined in the fight. Gens. Forrest, Armstrong, Roddey and Adams escaped, with a number of men, under cover of darkness. A portion of Upton's division pursued on the Burnsville road until long after midnight, capturing four guns and many prisoners. Wilson had engaged and in support 8,000 men. His loss was 44 killed, 277 wounded and seven missing. Forrest's loss in killed and wounded was less. It was one of the most remarkable feats ever accomplished by cavalry, and its result was the capture of 2,700 prisoners, many colors, nearly 2,000 horses, 104 field and siege guns and an immense quantity of ammunition. Wilson destroyed the arsenal, with 44 buildings, covering 13 acres, filled with machinery and munitions, powder works, three gun foundries, three rolling mills and several machine shops, and large accumulations of quartermaster and commissary stores. On the 3d Upton's division was sent from Selma to open communication with McCook and Croxton, west of the Cahaba. McCook had found Jackson's cavalry between himself and Croxton, and after skirmishing with it at Scottsville, had retired east of the Cahaba. Nothing was heard of Croxton and Upton, and McCook returned to Selma on the 6th. Croxton made a wide detour to the west and south of Tuscaloosa, and then northward and eastward across Alabama into Georgia before rejoining the corps. Preparations were now made to march on Montgomery. It was necessary to prepare 900 feet of bridging to cross the Alabama River, which was running high, horses enough had been captured to mount the whole command, supplies in the country were abundant, and on the 9th the entire command, except Croxton's brigade, started for Georgia by way of Montgomery. When the advance, which had not been strongly resisted, was near Montgomery on the 12th, the mayor surrendered the city, Adams, who was in command, having retreated, after burning 90,000 bales of cotton. With bands playing and colors flying the column marched through the city and encamped. Here five guns, a large quantity of stores, small arms and cotton were destroyed, also five steamboats loaded with military supplies. On the 14th the command moved with the greatest celerity to secure the crossings of the Chattahoochee at Columbus, on the direct road to Macon and West Point, further up the river. On the afternoon of the 16th Upton's division, in the advance on the Columbus road, struck Buford's cavalry pickets and drove them rapidly through Girard to the lower bridge over the Chattahoochee. The bridge was fired by the Confederates before it could be seized, and it was then decided

to make a night attack upon the central bridge, one of the three that crossed the river at this point. Three hundred men of the Third Iowa cavalry, properly supported, were selected to make the attack. The lines were quietly formed and moved up to within range of the intrenchments covering the bridge, and at a signal the attack began at 9 P.M.; the troops opened a rattling fire from their Spencer rifles, which was replied to by a storm of canister from 27 guns, but the Iowa men went over the works at many points and all rushed for the bridge. At the same time the Confederates tried to escape by the bridge, which was so crowded with the men of both forces that the Confederates holding the works at the east end of the bridge and commanding it with two guns, were restrained from firing and the Union forces made a rush upon them and gained possession, and Columbus was taken. Wilson's loss was six killed and 24 wounded. He captured 1,200 prisoners, nearly half of the militia that had defended the place under command of Gens. Howell Cobb and Robert Toombs. Columbus was one of the great manufacturing centres of the Confederacy, and its capture resulted in the destruction of a great quantity of war material, 63 guns, the ram *Jackson*, mounting six guns, 125,000 bales of cotton, 15 locomotives, 250 cars, a navy yard and armory, two rolling mills, powder magazines and an arsenal, with a great quantity of machinery, two iron-works, three foundries and 10 mills and factories turning out war material. The Confederates abandoned and burned the gunboat *Chattachoochee* 12 miles below Columbus. On the same day that Wilson captured Columbus, La Grange's brigade captured West Point. La Grange had been detached at Tuskegee and marching northeast, after some sharp skirmishing, appeared before West Point about 10 A.M. of the 16th to find that the bridge spanning the river was defended by an earthwork, mounting three guns, and held by Gen. R. C. Tyler with about 265 men. The fort was taken after a hard fight, during which La Grange's men bridged the ditch of the work, under fire. General Tyler and 18 of his men were killed, 28 wounded and 218 captured. La Grange had seven killed and 29 wounded. The captures were three guns, 500 stands of small arms, 19 engines and 245 cars loaded with army supplies. After destroying the bridges, railway equipment and stores, La Grange moved toward Macon. With the main column Wilson also marched for the same place on the 18th and when nearing the city, on the 20th, his advance was met by a communication from General Beauregard, with information of a truce between Generals Johnston and Sherman. Before the communication could reach Wilson, who was marching near the rear of his column, his advance had dashed into Macon and received the surrender of Gens. G. W. Smith, Howell Cobb and other prominent officers, and these, with the garrison, were held as prisoners of war. Here Wilson heard of the surrender of General Lee, and the next day, 21 April, he received a dispatch from General Sherman to suspend hostilities until notified of the result of the negotiations then pending between Sherman and Johnston. The surrender of Macon included four generals, 3,500 men, five colors, 60 guns, a large number of small arms and great quantities of military stores and supplies.

Croxton, who had been detached from McCook's division at Elyton on 27 March, rejoined the corps at Macon 1 May. He had captured Tuscaloosa and advanced as far as Bridgeville, then returned to Tuscaloosa and Jasper, thence his line of march was 100 miles north of that pursued by Wilson, and on the way through Alabama he had a sharp engagement at Blue Mountain, near Talladega. He marched 653 miles, most of the time through a mountainous country, so destitute of supplies that his command could be subsisted and foraged only by the greatest efforts. Swimming four rivers, destroying five large iron-works — the last in the cotton States — three factories, numerous mills, immense quantities of supplies, capturing four guns and several hundred small arms and near 300 prisoners, he rejoined the corps with men and horses in fine condition. He lost in all 172 officers and men. The closing act of Wilson's campaign was the capture of Jefferson Davis by regiments from his command.

In the campaign Wilson had marched 525 miles, captured five fortified cities, 288 guns, 6,820 prisoners and 23 colors. He subsequently paroled over 59,000 officers and men of the armies of Lee, Johnston and Beauregard, and had destroyed a vast amount of property of every kind. He lost 99 killed, 598 wounded and 28 missing, an aggregate of 725.

He had conducted the most notable cavalry movement of the war, none other equaled it in skilful planning, bold and successful execution. Consult 'Official Records' (Vol. XLIX); The Century Company's 'Battles and Leaders of the Civil War' (Vol. IV); Cox, 'The March to the Sea'; Piatt, 'Life of Gen. George H. Thomas'; Boynton, 'Gen. Geo. H. Thomas at Nashville.'

E. A. CARMAN

WILTON, Joseph, English sculptor: b. London, 17 July 1722; d. there, 25 Nov. 1803. He studied in Paris and in Rome, and while at Rome in 1750 won the gold medal awarded for sculpture by Benedict XIV on the occasion of his jubilee. He returned to England in 1755 and in 1758 became director of the art gallery of the Duke of Richmond. He was one of the founders of the National Academy and one of its first exhibitors. His busts and monuments were in much demand, among the former being those of Bacon, Cromwell, Isaac Newton, Chesterfield, Chatham and other prominent characters. From 1790 until his death he was keeper of the National Academy.

WILTON, Me., town in Franklin County, on the Maine Central Railroad, about eight miles southwest of Farmington. It was settled in 1789 and in 1803 was incorporated. It has lumber mills, trunk and carriage factories, creameries, woolen mills and agricultural implement works. The educational institutions are Wilton Academy, public schools and a school library. Pop. 2,143.

WILTON CARPET, a variety of carpet made similar to Brussels, excepting that the wire is flattened instead of being round and has a groove along the upper surface, which acts as a director for the knife by which the loops are cut and the wire liberated.

WILTS, or WILTSHIRE, England, a southwestern county bounded on the north and northwest by the county of Gloucester, on the west by Somerset, on the south by Dorset and Hampshire, on the east by Hampshire and Berkshire; area, 1,350 square miles. The county town is Salisbury. The north is principally a fertile flat, with scarcely any perceptible slope, except on the frontier where it begins to rise in the direction of the Cotswold Hills and near the centre, where it is broken by a ridge of downs; the south, though presenting at a distance the appearance of an almost uninterrupted plain, has an undulating surface, broken by downs and intersected by some fertile and well-watered valleys. In this south division is Salisbury Plain, an elevated plateau, covered with a scanty herbage. On the plain are the megalithic remains of Stonehenge, situated about nine miles north of Salisbury and those of Avebury, about five miles west of Marlborough. The chief rivers are the Bristol Avon, the Salisbury Avon and its tributaries Bourne, Wily and Nadder. Though the arable land is of considerable extent, the larger proportion of the surface is kept in pasture, devoted chiefly in the south division to the rearing of sheep, and in the north to cattle-grazing and the dairy. Wiltshire bacon and cheese are famous. The manufactures comprise woolen goods for which the principal localities are Wilton, famous particularly for carpets, Bradford, Trowbridge, Westbury, etc.; excellent cutlery and steel goods at Salisbury, ropes and sacking at Marlborough, large engineering works at Devizes; and iron ore found in mines nearby is smelted at Westbury. Pop. 286,822.

WIMAN, Erastus, American mercantile agent: b. Churchville, Ontario, 21 April 1834; d. Saint George, S. I., 9 Feb. 1904. He entered the mercantile agency service in 1858 and in 1867 removed to New York, where he became interested in rapid transit schemes for Staten Island. He increased the number of steamboat trips between that island and New York from 15 to 65 a day, built the Arthur Kill bridge and in 1902 secured congressional authority for the construction of a tunnel under New York Bay connecting New York, Long Island and Staten Island. His later years were clouded by financial reverses and the frustration of his extensive plans for rapid transit. He wrote 'Chances of Success' (1892).

WIMBLEDON, wim'bl-dŏn, England, a town of Surrey, eight miles southwest of Trafalgar Square, London. It is practically a suburb of London, being located at the northeast extremity of the common of same name, which until 1889 was well known in connection with the shooting competitions of the National Rifle Association. It has a free library, almshouses, hospitals and many fine residences, being a favorite residential locality. Area, 3,221 acres; pop. 58,003.

WIMBORNE, wim'bèrn, or **WIMBORNE MINSTER,** England, a market-town of Dorsetshire, on the Wimar Allen River, near its confluence with the Stour, about seven miles northwest of Bournemouth. It is of historical interest in connection with its fine cruciform minster, the collegiate church founded by Edward the Confessor which succeeded the convent established by Saint Cuthburh, King Ine's sister, in 705. The minster exhibits various styles of transitional architecture from the Norman onward, has a central and a west tower and contains several interesting features, including the tomb of Ethelred I, and a mediæval chain-library, one of the few in existence where the books are chained to the shelves. The grammar school in the town was founded in 1496. Pop. about 5,000. Consult Hutchins, John, 'The History and Antiquities of the County of Dorset' (Westminster 1861); Perkins, 'Wimborne Minster and Christ Church Priory' (1899); Yeatman, 'Wimborne Minster' (1878).

WIMPLE, or WIMPEL, a covering of silk or linen for the neck, chin and sides of the face, worn usually out of doors. It is still retained as a conventual dress for nuns.

WINAMAC, win a-măk, Ind., county-seat of Pulaski County, on the Tippecanoe River, and on the Pittsburgh, Cincinnati and Chicago Railroad, about 90 miles southeast of Chicago and 23 miles northwest of Logansport. It has considerable trade; the principal shipments are farm and dairy products. The principal public buildings are the courthouse, four churches and the public and parish schools. Pop. 1,800.

WINANDERMERE. See WINDERMERE.

WINANS, Ross, American inventor; b. Vernon, N. J., October 1796; d. Baltimore, Md., 11 April 1877. He went to England to examine English railroad systems in the interest of the Baltimore and Ohio Railroad; and after his return built the first locomotive used on that railroad. He also invented the camel-back locomotive and the eight-wheeled car, and established in Baltimore some of the largest machine shops in the United States. He was active in political matters prior to the Civil War and in 1861 was elected to the extra session of the Maryland legislature, but was imprisoned in Fort McHenry. He was author of several pamphlets on religious subjects and also of 'One Religion, Many Creeds' (1870).

WINANS, Thomas DeKay, American engineer, son of Ross Winans (q.v.): b. Vernon, N. J., 6 Dec. 1820; d. Newport, R. I., 11 June 1878. He was taken into partnership by his father on coming of age and was sent by him in company with his brother William to make contracts with the Russian government for furnishing and managing the equipment of a railroad between Moscow and Saint Petersburg. With Andrew M. Bostwick and Joseph Harrison he entered into a contract for $3,000,000, and afterward was engaged in other lucrative contracts with Russia. Upon his return to the United States he became interested in invention, and with his father and brother invented a system of steam navigation known as the "cigar-ship"; a tubular adjustment for the feeding of young trout; and various other mechanical devices.

WINATSHIPUM INDIANS, a small tribe of the Salishan stock of North American Indians, also known as Piskwaus or Pisquouse, residing on Wenatchee River (whence the name of the tribe) and the north branch of Yakima River in Kittitas County, Wash. They took part in the Yakima treaty of 1855, but do not live on the reservation. There are six smaller tribes or bands connected with them and speaking the same language.

WINCHELL, Alexander, American geologist: b. North East, Dutchess County, N. Y., 31 Dec. 1824; d. Ann Arbor, Mich., 19 Feb. 1891. He was graduated from Wesleyan University, Middletown, Conn., in 1847, became professor of physics and civil engineering at the University of Michigan in 1853 and of botany and geology there in 1855. He served as State geologist of Michigan 1859–62, professor of geology in the Kentucky University 1866–69, director of the Michigan Geological Survey 1869–71, and chancellor of Syracuse University 1873–74. From 1879 till his death he was professor of geology and palæontology in the University of Michigan. He lectured extensively and published 'Sketches of Creation' (1870); 'Geological Chart' (1870); 'The Doctrine of Evolution' (1874); 'Science and Religion' (1877); 'Preadamites' (1880); 'Sparks from a Geologist's Hammer' (1881); 'World-Life' (1883); 'Geological Studies' (1886); 'Walks and Talks in the Geological Field' (1886).

WINCHELL, Newton Horace, American geologist, brother of Alexander Winchell (q.v.): b. North East, N. Y., 17 Dec. 1839; d. 2 May 1914. He was graduated at the University of Michigan in 1866. In 1869–70 he was assistant State Geologist of Michigan; he assisted in the Ohio Geological Survey in 1870–72; and in 1872–1900 he was State Geologist of Minnesota, and also professor of geology and mineralogy at the University of Minnesota in 1873–1900. He was archæologist of the Minnesota Historical Society after 1906. He served as president of the American Geological Society in 1902; and he edited the *American Geologist* with his son, Horace V. Winchell, an economic geologist; he was joint author of 'The Iron Ores of Minnesota' (1891), and with another son, Alexander N. Winchell, professor of mineralogy and petrology at the University of Minnesota, he was author of 'Elements of Optical Mineralogy' (1909). Independently he was author of 'Catalogue of the Plants of the State of Michigan' (1861); 'Geology of Ohio and Michigan' (1872–1900); 'The Aborigines of Minnesota' (1911); 'Weathering of Aboriginal Stone Artifacts' (1913).

WINCHENDON, Mass., town in Worcester County, on the Miller River, and on the Boston and Albany and Boston and Maine railroads, 36 miles north-northwest of Worcester and 68 miles northwest of Boston. Electric lines connect it with nearby cities. It was settled in 1752 and incorporated as a town in 1764; the town includes the villages of Winchendon, Waterville and Winchendon Springs. It is principally a manufacturing town; the chief manufactures are woodenware, tubs, pails, etc., wood-working machinery, toys, ice-cream freezers, cotton goods, rattan and reed furniture, knit goods, spools, bobbins, chairs, etc; there is a national bank with a capital of $200,000, and a savings bank, one of the best in the State. It contains Murdock High School established in 1865 with a school library of about 1,500 volumes, and occupying a fine building valued at $100,000; the Beals Memorial Library of 12,500 volumes. There is an excellent school system, a board of trade and clubs for both women and men. There are three banks with combined resources of over $3,600,000. The assessed valuation of the town is $4,500,000. The town owns and operates the system of waterworks. A modern hydro-electric plant furnishes current for lighting and power. Pop. 5,968.

WINCHESTER, Caleb Thomas, American scholar and educator: b. Montville, Conn., 18 Jan. 1847. He graduated from Wesleyan University 1869, and studied at the University of Leipzig 1880–81. He served his Alma Mater as librarian 1869–73; was professor of rhetoric and English literature 1873–1890 and since then professor of English literature. He is a lecturer of great charm and wide reputation. He is the author of 'Five Short Courses of Reading English Literature' (1892; 3d ed., 1911); 'Some Principles of Literary Criticism' (1899); 'The Life of John Welsey' (1906), considered by many critics the best published; 'A Group of English Essayists' (1910); 'Representative English Essays, with introduction and notes' (1914); 'Wordsworth — How to Know Him' (1916).

WINCHESTER, Charles M., American printer and publisher: b. Providence, R. I., 2 April 1867. He is the son of a clergyman who was chaplain of the 12th Rhode Island regiment in the Civil War and for many years in charge of the First Christian Church at Middletown, N. Y. Mr. Winchester was educated in the public schools of Middletown; learned the printing trade at Dayton, Ohio, and was proofreader and foreman of a composing room at Akron, Ohio. He returned to New York City in 1891, where he was employed as a compositor, proofreader and foreman of a composing room. In January, 1896, he moved to Albany, N. Y., to manage a branch in that city for a New York printing concern, which was later merged with the J. B. Lyon Company, of which he became general manager, vice-president and subsequently president and one of the owners. Mr. Winchester became associated in many clubs and fraternal societies of the city of Albany, being active head of several, including the Albany Chamber of Commerce, to which he was elected President in 1919 and again in 1920.

WINCHESTER, England, an ancient city, capital of Hampshire, situated on the right bank of the Itchen, 11 miles north of Southampton. The most important edifice is the cathedral; the oldest parts date from the 11th century, but the greater part of the main building was erected at various times from the 13th to the 16th century, William of Wykeham (1324–1404) having an important share in the work. It has a low central tower which alone rises above the general level of the roof; length from east to west, 545 feet, width of the transepts 186 feet. The length of the nave, which has a beautiful interior, is 351 feet, height 86 feet; the transept contains several beautiful chapels and altars. Numerous monuments include the tombs of William Rufus, of Edmund, son of King Alfred, of William of Wykeham, Cardinal Beaufort, and of Izaak Walton; the shrine of Saint Swithin, etc. It is said that there was a Christian church erected at Winchester in the latter part of the 2d century. Late in the 3d century it was converted into a temple to Wodin. In the second half of the 7th century, the exact date not being definitely known, Winchester became an episcopal see with an unbroken line of

Manassas, Gen. "Stonewall" Jackson, under Johnston's orders, withdrew from the place and retired up the Shenandoah Valley, and the Union troops, under General Banks, occupied it on the 12th. General Shields, who had followed Jackson up the valley, with a division of Banks' command, fell back to Winchester and Jackson followed him as far as Kernstown (q.v.), four miles south of Winchester, where Shields attacked and defeated him on 23 March; Jackson again retreating up the valley, Banks following and finally taking up a fortified position at Strasburg. Jackson flanked Banks out of Strasburg by moving through Luray Valley and defeating Colonel Kenly at Front Royal (q.v.) 23 May, and Banks retreated to Winchester closely pursued by Jackson.

Winchester, First Battle of.— Banks arrived in Winchester late on the 24th with about 8,000 men and 16 guns. Colonel Donnelly's small brigade was put in position to cover the Front Royal and Millwood roads, and was supported by eight guns, judiciously placed on rising ground. Colonel Gordon's brigade, on the right, held a low ridge running southwest from the town and west of the Valley turnpike, a little over half a mile from the suburbs. Its left rested on the turnpike and its right extended westward along the ascending ridge in front of Winchester. Skirmishers were thrown out in advance and guns were placed on either flank. Five companies of Michigan cavalry were held in reserve under cover of the ridge. Between Gordon and Donnelly was an interval of nearly a mile, which was filled by the principal part of General Hatch's cavalry brigade and two guns. The line formed the arc of a circle, covering Winchester from the west around by the south to the east. Jackson confronted this position with 16,000 men and 48 guns, and with the main body lay close to Gordon, while Ewell, with two brigades which had marched directly from Cedarville on Winchester, bivouacked opposite Donnelly's position. Jackson's plan was to hold Gordon fast, throw Ewell upon Donnelly, and then move his main body around Gordon's right, and he expected to advance upon a disorganized and demoralized army. At dawn of the 25th Ewell advanced the 21st North Carolina and opened with his artillery, whose shells fell among Donnelly's men, as they were preparing coffee and brought them to arms as they saw the Carolinians advancing in line across an open field upon the centre of the position crossing the Front Royal road. The North Carolina men met a severe front and flank fire from the stone fences, and as they fell back Captain Best's guns threw canister into their disordered ranks and they left the field with a loss of 80 officers and men, including the two field officers with them. A Confederate officer says, "The slaughter was appalling and the survivors fled to the rear in the utmost confusion." Ewell now brought up two batteries, and an artillery duel ensued, which soon ceased as a heavy fog settled over the field. Ewell then made an unsuccessful attempt to turn Donnelly's right and then endeavored to turn his left and gain the Martinsburg road in his rear. The attempt was checked, Donnelly losing some ground. But at this moment he received an order to retreat, as Gordon had been driven from position and was in retreat through Winchester. Donnelly moved his three regiments and guns from the field in perfect order, under a heavy fire of shot and shell, and continued his retreat, keeping to the right of the Martinsburg road. He had made a successful resistance of over four hours against double his number, with trifling loss.

Jackson attacked Gordon's small brigade with six brigades, his attack beginning at daybreak, and being several times repulsed. Finally he got artillery in position and opened on Gordon's front and gradually worked his infantry toward the left. Then he moved two brigades around Gordon's right. Gordon detected the movement while it was in progress and changed position to meet it, pouring a destructive fire of musketry into the Confederate ranks, making great gaps in the line, without checking its advance; the gaps were closed and with almost perfect alignment the two brigades came on and flanking Gordon's two right regiments drove them back in some disorder. The five companies of Michigan cavalry were now brought up and as quickly swept away. At this juncture Jackson ordered forward his entire line of six brigades and Gordon ordered a retreat through Winchester, which was conducted in a manner to command Jackson's admiration. There was some confusion in the streets of the town, but once clear of it, Hatch's cavalry and the artillery covered the withdrawal, until the infantry was well on the Martinsburg pike. Jackson with his main body pursued five miles beyond Winchester and Banks continued his retreat to the Potomac, crossing it at Williamsport on the 26th. Banks' loss May 23-25, including Front Royal and the retreat from Strasburg to the Potomac, was 62 killed, 243 wounded and 1,714 missing. Jackson's loss was 68 killed, 329 wounded and three missing. Jackson remained at and in the vicinity of Winchester until 31 May, when, his rear being threatened by the converging columns of Fremont from the west and McDowell from the east, he retreated up the valley and the Union troops reoccupied Winchester. Consult 'Official Records' (Vol. XII); Allan, 'Jackson's Valley Campaign.'

During Lee's campaign against Pope the town was occupied by Gen. Julius White with a brigade of over 2,000 men. On the night of 2 Sept. 1862 White, under General Halleck's order, spiked four heavy siege guns in the works and withdrew to Harper's Ferry; the Confederates occupying the place next day. The Confederates held the place in small force until 3 December, when, upon the advance of a Union column from Harper's Ferry, under General Geary, they retired, and Geary occupied the town next day. Geary soon withdrew and the Confederates reoccupied and held the town until near the end of December, when it was again taken by Union troops under General Milroy. Milroy fortified the place and occupied also Berryville and Romney, with outposts toward Strasburg and Front Royal. Harper's Ferry, Martinsburg, Williamsport and posts westward to Cumberland and New Creek were held by Union troops belonging to Gen. B. F. Kelley's command.

Winchester, Second Battle of.— When General Lee began his preparations for the second invasion of Maryland, which culminated in the battle of Gettysburg, he turned his

thoughts to the clearing of the Shenandoah Valley. At this time Winchester was held by General Milroy, with the two brigades of Gen. W. L. Elliott and Colonel Ely, numbering about 7,000 effective men. Colonel McReynolds' brigade of 1,800 men was at Berryville. The main works defending Winchester were on a ridge north of the town and consisted of two forts known as the "main fort" and the "Star fort," mounting four 20-pounder Parrotts and two 24-pounder howitzers. Surrounding these were smaller works connected by rifle-pits. The expressed object in holding the place was to observe and hold in check the enemy in the valley, and to secure the Baltimore and Ohio Railroad against depredations. Milroy was expressly instructed to undertake no offensive operations in force. On 7 June General Lee began his operations in the valley by ordering General Imboden, in the upper valley, to make a demonstration with his cavalry brigade on Romney in order to cover the movement against Winchester and prevent the Union troops at that place from being reinforced by Kelley's troops on the line of the Baltimore and Ohio Railroad. General Jenkins' cavalry brigade was ordered to join Ewell's infantry corps near Front Royal. Both Imboden and Jenkins were in position by the 10th, and on that day Ewell set out from near Culpeper Court House for Winchester by way of Gaines' Cross Roads, Chester Gap and Front Royal, to Cedarville, which was reached on the 12th. Here, next day, Ewell detached Rodes' division and Jenkins' cavalry brigade to move on Berryville and endeavor to capture McReynolds' brigade, but, warned by Milroy, McReynolds made good his retirement, with small loss, joined Milroy at Winchester on the night of the 13th, and was assigned to the Star fort, immediately north of the main work. On the same day Early's division marched on Winchester by Newtown and the Valley pike, while Edward Johnson's division moved upon the town by the direct road from Front Royal. The two divisions, driving in Milroy's outposts, were in position before Winchester on the evening of the 13th. For some days Milroy had felt the pressure from Confederate cavalry, but had no idea that Lee was threatening the valley until a prisoner taken in a skirmish on the Strasburg road, on the evening of the 13th, informed him that he was confronted by Ewell's corps and that Longstreet's was near. Fully recognizing the fact that an orderly withdrawal was impracticable, he resolved to act on the defensive, and, if not relieved, force his way through what might appear the weakest part of his lines. At night of the 13th Ewell ordered Early to attack the works on the north and west of the town next morning, while, as a diversion, Johnson demonstrated against the east and southeast. In the forenoon Johnson made his attack on the eastern side of the town, between the Millwood and Berryville roads, held by Colonel Ely's brigade, and was repulsed by the Eighth and 87th Pennsylvania, which charged Johnson's retreating troops, but were speedily driven back by fresh troops, and after some sharp fighting Johnson gained part of the town, but was quickly shelled out and made no further effort. West of the ridge on which the main forts were thrown up, and about 1,300 yards distant, is another parallel ridge, called Flint Ridge, where an isolated earthwork of slight strength had been thrown up to command the Pughtown and Romney roads. It was held by the 110th Ohio, a company of the 116th, and a regular battery, commanded by Lieutentant Wallace F. Randolph, all under command of Col. J. W. Keifer. Early, leaving Gordon's brigade south of the town to engage Milroy's attention, moved with the remainder of his division to the left and west, then north, crossed the Romney road, and about 5 P.M., having gained Round Mountain, south of the Pughtown road, and put 20 guns in position, without being perceived, opened an unexpected fire on Keifer's work and soon silenced Randolph's battery, upon which Hays' brigade, in two lines, made a quick dash, and after a stubborn resistance carried the work, and captured the battery of six guns. Keifer, with a loss of over 40 men, withdrew under cover of the fire from the guns of the main works. This was followed by an artillery duel which was kept up until 8 P.M., during which Milroy withdrew his detachments to his main works. Darkness ended the contest.

Milroy was now in a critical position. His cannon ammunition was nearly exhausted and he had but one day's rations for his men. At 9 P.M. he assembled his brigade commanders, and it was concluded to give up further effort to defend the place, to abandon all the artillery and wagons, and to force a way through the Confederate lines that night, taking with them only the horses, small arms and usual supply of ammunition. All the guns were spiked and the ammunition thrown into the cisterns. At 1 A.M. of the 15th Milroy, abandoning his sick and wounded, avoiding the town, moved silently through a ravine about a mile and struck the Martinsburg pike, which was followed cautiously, with many halts to close up the stragglers, for about three miles, when, about 3.30 A.M., Elliott's brigade, which was in the advance, was fired upon by Confederate skirmishers, and it was soon ascertained that their main body was east of and very near the road. The retreat had been anticipated and intercepted. Under Ewell's order, General Johnson had left one brigade to prevent Milroy from escaping toward the east, and moved with the remainder of his division by way of Jordan Springs to Stephenson's Depot, about five miles north of Winchester, to intercept the retreat in that direction. Just as Johnson's head of column reached the railroad, 200 yards from the Martinsburg pike, Milroy's men were heard coming down the road and Johnson formed his line on elevated ground in a woods east of the road and in a field south of and adjoining the woods. The greater part of his men were sheltered by a stone fence which bounded a railroad cut. As soon as Elliott took in the situation he formed line of battle with his three leading regiments to push back the Confederates and thus clear the way for the rest of the column to pass on toward Martinsburg. An hour's fight ensued with varying success, Johnson's right being forced back and his artillery silenced, but the left of his line held firm against all efforts to shake it. The main road being blocked, Milroy determined to try another, and directed the troops to fall back a short distance and turn to the right. Part of them did so, but the greater

number filed to the left, leaving the Martinsburg road and taking that to Bath. The diverging columns could not be reunited. A part of the command, accompanied by Milroy, reached Harper's Ferry by way of Smithfield late in the afternoon. Those retreating on the Bath road made good their escape, crossed the Potomac at Hancock and rallied to the number of 2,700 at Bloody Run. The greater part of Ely's and McReynolds' brigades were captured. Johnson claims the capture of 2,300 men, 175 horses and 11 colors. The capture of Winchester and defeat of Milroy gave the Confederates 28 guns, 300 loaded wagons, many horses and 4,000 prisoners. The Union loss was 95 killed, 348 wounded and 4,000 captured or missing. The Confederate loss was 47 killed, 219 wounded, three missing. Consult 'Official Records' (Vol. XXVII); Doubleday, 'Chancellorsville and Gettysburg.'

On marching into Maryland General Early left a small garrison at Winchester, and after the return from Gettysburg Lee's army was encamped around the place until it fell back beyond the Rappahannock. The town was not then reoccupied in force by Union troops, being only visited occasionally by small detachments from Harper's Ferry and Martinsburg. It was subject also to Confederate forays from the upper valley. In December 1863 General Early was sent into the valley, and throughout the winter and early spring of 1864 kept his troops very active, occasionally making dashes into Winchester. On 29 Feb. 1864 General Sigel was assigned to the command of the Union troops in the lower valley, and soon thereafter Winchester was occupied as an outpost to Harper's Ferry and Martinsburg. Sigel was relieved by General Hunter after the battle of New Market (q.v.), 15 May, and when Hunter was repulsed at Lynchburg and forced to retreat to the Kanawha General Early moved down the valley, and driving everything out of it, encamped near Winchester, 3 July, preparatory to his attempt on Washington (q.v.). After his failure on Washington Early returned to the lower valley and being hard pressed from the east and north fell back toward Strasburg, at the same time sending Ramseur's division of infantry toward Stephenson's Depot, a few miles northeast of Winchester, to support his cavalry and check General Averell's division of Union cavalry, advancing from Martinsburg. Averell defeated Ramseur at Stephenson's Depot (q.v.), 20 July, and followed him through Winchester. He was joined by General Crook's division, on the 22d, Crook assuming command, and the two divisions of 11,000 men advanced to Kernstown on the 23d. Early returned, defeated Crook at the second battle of Kernstown (q.v.) 24 July, drove him through Winchester and across the Potomac, and reoccupied Winchester and Martinsburg. Early's successes called for a strong commander of the Union forces to oppose him, and General Sheridan was selected. On 7 August when Sheridan assumed command, near Harper's Ferry, Early's army was concentrated west of the Opequon River, covering Winchester and Bunker Hill. Sheridan advanced from Halltown toward Winchester, on the morning of the 10th, and Early, abandoning Bunker Hill and Winchester, fell back to Strasburg to await reinforcements coming from Lee's army at Richmond. Sheridan followed to Cedar Creek on the 12th. Early's reinforcements arriving, Sheridan's infantry fell back to Winchester on the night of the 16th, the cavalry following next day. From Winchester Sheridan, on the 17th, fell back to Berryville, behind the Opequon, leaving his cavalry to cover the withdrawal. Wilson's cavalry division, Lowell's cavalry brigade and Penrose's brigade of New Jersey infantry, 850 men, were ordered to cover the flank of the army in its march from Winchester to Berryville. The Jersey brigade was deployed along a small branch of the Opequon, south of and near Winchester, with dismounted cavalry on the flanks, the remainder of the cavalry massed near the town. Early had followed Sheridan from Cedar Creek and, in the afternoon of the 17th, his cavalry advanced driving in the Union cavalry, was checked and held by the Jerseymen, until Wharton's division of infantry attacked their right and Ramseur's their front, while Gordon's division advanced against the cavalry. Under this pressure the entire Union line gave way about dark and fell back to Summit Point. The Jersey brigade lost 97 killed and wounded and about 200 prisoners. The cavalry had about 50 captured. Early again occupied Winchester and advanced to confront Sheridan at Halltown. For some days both parties were feeling each other's lines and suffering some losses, and 2 September, General Averell, who had been guarding the crossings of the Potomac, south of Hancock, advanced through Martinsburg to near Bunker Hill, where he attacked and routed General Lomax's cavalry division of two brigades, capturing two battle-flags, 55 prisoners, some wagons and a herd of cattle, finally driving Lomax nearly into Winchester next day, but Averell, in turn, was driven back by Rodes' infantry division. On the 13th General McIntosh, with five cavalry regiments and two guns, started from Sheridan's lines near Berryville, captured some prisoners, and on approaching Winchester caught sight of an infantry line and charged it, driving it to a piece of woods, which he surrounded, capturing the Eighth South Carolina of Kershaw's division, with its battle-flag. The rest of Kershaw's division advanced and McIntosh fell back with his 143 prisoners. These minor encounters were followed on the 19th by the greatest battle fought at Winchester, which to distinguish it from other battles of Winchester is known as the battle of the Opequon (q.v.), in which Sheridan with 38,000 men defeated Early's 15,000, and drove him from Winchester up the valley, not again to return. From this to the close of the war Winchester remained in Union possession. See also SHENANDOAH VALLEY, MILITARY OPERATIONS IN.

E. A. CARMAN

WINCHESTER COLLEGE, a public school at Winchester, England, the oldest of the "Great Public Schools" of that country. It was founded in 1382 by William of Wykeham, and was opened in 1393, although its buildings were not finished until 1395. The original foundation consisted of a warden, 10 fellows, three chaplains, 16 choristers and 70 students who were to live at the school. Outside scholars, or "Commoners," to the number of 10, were admitted, and this number was afterward increased. The original buildings are still

in use and are exceptionally fine architectural types. Newer buildings have been added at various times as the requirements of the school have demanded them. The Public School Commission in 1862 abolished the sinecure fellowships, thereby saving for the school considerable revenues for improvements. The original foundation openings are filled by competitive examinations, and occur at the rate of about 12 annually. The school from the time of its establishment prepared for New College, Oxford, and it has six scholarships at that institution. The new house built for the "Commoners," together with the accommodations for the 70 students in the old house, permit a total student body of about 450. The curriculum is classical in its base, gives mathematics, one modern language, and chemistry, geology or physics. There is also an army class which offers special instruction for entrance examinations into the army. Consult Holgate, C. W., 'Winchester Long Rolls' (1899); Leach, A. F., 'History of Winchester College' (London 1899); Vaughan, John, 'Winchester Cathedral Close' (New York 1914); Shawell, L. L., 'Enactments in Parliament' (4 vols., Oxford 1912).

WINCHESTER LINE. See BOUNDARIES OF THE UNITED STATES.

WINCKELMANN, vĭnk'ĕl-mān, **Johann Joachim,** German archæolgist and art historian: b. Stendal, Prussia, 9 Dec. 1717; d. Trieste, Austria, 8 June 1768. The son of a poor cobbler he acquired his early schooling as charity pupil in his native town. He was graduated from a gymnasium at Berlin, and later studied theology at Halle. He next undertook the study of medicine at Jena, but was unable to complete the course because of lack of means and for a number of years he was obliged to serve as private tutor and schoolmaster, but in 1748 he was appointed by Count Heinrich von Bünau secretary in his library at Nöthnitz, near Dresden. In 1755 he joined the Roman Catholic Church, and through the efforts of the papal nuncio at Dresden was enabled to visit Rome. Here he became librarian to Cardinal Archinto after whose death he entered the service of Cardinal Albani, an art connoisseur and collector, and gave the public his ideas on ancient art. The more important of his works are 'Geschichte der Kunst des Alterthums' (1764); and 'Monumenti antichi inediti' (1767–68); with various sets of letters on the remains at Herculaneum and Pompeii. He was recognized as the leading authority in Europe in the field to which he had devoted himself. In 1768 he revisited Germany, but at Munich a longing for Italy so overmastered him that he determined to return. Going by way of Vienna, he was well received there, and was presented to the Empress Maria Theresa, who bestowed rich presents on him. At the beginning of June he departed for Trieste, where, for the sake of the gold medals and valuables in his possession, he was murdered by a fellow-traveler, named Arcangeli. The robber was interrupted, and fled without securing any booty, but was subsequently taken and executed. A collective edition of Winckelmann's works was published (1808–20) and another (1825–29). Winckelmann is considered by all authorities as the founder of modern scientific archæology and his conception of the beautiful elicited Lessing's 'Laokoon.' Consult Justi, 'Winckelmann und seine Zeitgenossen' (2d ed., 3 vols., Leipzig 1898); John, 'Biographische Aufsätz' (1866); Pater, Walter, 'The Renaissance: Studies in Art and Poetry' (London 1910); Vogel, in 'Allgemeine deutsche Biographie,' XLIII (1898).

WIND, a current of air established at certain times and places within the body of the atmosphere at large, and flowing during periods longer or shorter in certain general directions; such currents being occasioned chiefly by differences of temperature at different times or localities, and by variations in the production and condensation of watery vapor. The portion of the surface of the globe over which any particular wind, permanent or occasional, may extend, is comparatively small, as is consequently the tract of the entire aerial ocean resting on that surface that is involved. At all times, also, there are parts of the atmosphere that are sensibly at rest or calm; and such apparently motionless tracts of air are sometimes of very great extent. (For a statement of the physical properties of the air, see ATMOSPHERE; and in reference to the mechanical principles of equilibrium, mobility and disturbance of a fluid mass circumstanced as is the air, see PNEUMATICS). The atmosphere is held to the earth only by gravity and the action of this force does not interfere with its fluidity or elasticity, nor with the effect of any pressures acting at points within it; so that its parts have entire freedom of motion about or among each other, and it is in every part sensitive to the slightest disturbing forces. Since, however, the globe with its aerial envelope is to be regarded as moving in unresisting space, and since the friction of the earth's surface upon the lowest stratum of air, and of the strata successively one upon another, has sufficed to communicate to the entire body the earth's own velocity, it follows that the atmosphere, if it were left at rest within itself, must partake of the earth's movements as perfectly as if it were a solid part of that body. The simplest of the disturbances affecting the atmosphere are the movements of "atmospheric waves" of greater or less magnitude and duration, but of two sorts, the daily and the occasional or irregular, the occurrence of which is shown by certain periodical or rare, but gradual variations of barometric pressure. From the nature of the medium, these waves are, as compared with those of water, on a vast scale. The indications of the barometers at stations scattered over a large area of country show that these waves move singly, and indicate their breadth, and the direction and rate of advance; a generally increased or maximum pressure showing at a given time the presence of the crest, while at distances on either side of this a minimum pressure shows the margins or accompanying troughs of the wave. Of daily atmospheric waves, or tides, there are two: (1) that due to attraction of the sun and moon, and which in periods and character is, therefore, similar to the oceanic tides, but which, its maximum effect on the mercury column not exceeding $\frac{1}{10}$ of an inch, cannot be a cause adequate to produce winds; (2) the heat tide, or elevation of a crest of air along a meridional line following the sun at no great distance, while the cooling on the opposite side of the globe occasions the ad-

vance of a corresponding line of depression, this tide having, therefore, for its period a solar day, and within that period but a single crest, instead of two opposite ones. Beside these periodic fluctuations, there are occasional vast atmospheric waves, due perhaps to previous winds, to great local disturbances of temperature, or to combinations of causes not yet understood. The disturbances by heat that give rise to ordinary periodical or irregular winds are such as occur along certain latitudes, or as are local and irregular altogether. An increase of temperature equal to 50° F. dilates the air receiving it by only about one-tenth of its volume. From the direct rays of the sun air absorbs heat chiefly near the surface of the earth, and yet slowly even here, the warming of the air being more largely due to secondary radiation from the heated surface of the land or water. The heat acquired within a given time is usually by a very gradual increase and limited in amount. If the warming of the air is quite uniform over a large surface, the equilibrium between the affected and the surrounding bodies may be steadily adjusted and preserved, so that no wind shall result; and it is a common experience of the hot season that, though the air at a place may be intensely heated, or through many degrees within a few hours, yet no wind may occur. During subsequent cooling of the same body of air a wind is more likely to arise, and especially so if clouds form at no great distance. Very generally, however, the effect of heating a tract of air in excess over that around it is to occasion expansion and diminution of density; the column of air so affected moves or flows upward, and while the effect of its momentum further relieves its lowermost portions of pressure and diminishes the resistance they can oppose to the surrounding air, the ascending body, losing at considerable height its excess of heat, acquires the density of air at such elevation and flows over or outward, increasing the weight and pressure of some or all the surrounding portions. The lateral equilibrium below is thus destroyed and a double movement of the air established, the air flowing in from one or more directions below the heated space, and flowing out above. But the momentum acquired in some given direction by the air rushing into the affected space may predominate, and, the conditions of neighboring portions of air favoring, a wind may thus be established that shall blow far beyond the point of first disturbance, as well as successively affect portions of atmoshphere further back of it, and also extend widely, continuing for a long time before equilibrium and calm are restored. As a well-known fact, however, high or widely extending winds are more likely to arise just before or during storms in which a considerable body of watery vapor is condensed and precipitated from the air, and yet more likely to be felt chiefly after such storms. Winds are also known to be produced in consequence of rapid and great evaporation, and even during the rapid formation of belts or masses of cloud without rain. In all the great oceans, however, there are certain winds, called trade-winds, which always blow in the same direction, though with seasonal variations in the area over which they blow. These are cold currents of air constantly flowing in from the polar regions to replace the warmer and lighter air which is constantly ascending from the tropical belt and which finds its way back, at first entirely through the upper strata of the atmosphere, to the regions in which the cold currents take their rise. The direction of these winds, which is nearly due west, but slightly south or north, according as it is a northeast or southeast trade-wind, results from the axial rotation of the earth from west to east. The general character of the air-movement is twofold. There is a movement from the poles toward the equator, and a return movement from the equator to the poles. In low latitudes the latter takes place exclusively in the higher strata of the atmosphere, but in higher latitudes its effect is often felt on the surface of the earth. In these latitudes, then, the winds may be divided into equatorial and polar, the former being as a rule more or less westerly, the latter more or less easterly. The equatorial winds are distinguished in general by the highest temperature, the greatest degree of saturation, the most cloudy weather, the most frequent rainfall and the lowest atmospheric pressure; and the polar by the lowest temperature, the least degree of saturation, the clearest weather, the least rainfall, and the highest atmospheric pressure. This explains why the southwest wind is that which brings the most rain, and why a falling barometer is as a rule a sign of approaching rain, and also why the barometer, as is well known, usually shows an upward tendency with an east wind. Certain winds have a seasonal character, being either confined to certain seasons of the year, as the harmattan of the Guinea coast and the etesian winds that blow from the north in summer in the eastern part of the Mediterranean, or changing their direction at certain seasons, such as the monsoons of the Indian Ocean. (See ANEMOMETER; CHINOOK WIND; METEOROLOGY; SIROCCO). Consult Bigelow, F. H., 'Report on International Cloud Observations' (Washington 1901); Cave, C. J. P., 'Structure of the Atmosphere in Clear Weather' (New York 1912); Ferrel, W., 'Popular Treatise on the Winds' (New York 1889).

WIND CAVE NATIONAL PARK. This park, created by act of Congress on 9 Jan. 1903, is 12 miles northwest of Hot Springs in Fall River County, S. Dak. It is on the southeast slope of the Black Hills and has an area of nearly 15,000 acres. The cave has extensive galleries in Pahasapa limestone with many fine crystal formations on its walls. It was once the channel of subterranean streams and owes its origin to the solution of the limestone by water. The name is appropriate because at most times a strong air current is passing into or out of the narrow entrance to the cave. The park includes a game preserve of 4,160 acres in its northwestern corner, maintained by the United States Biological Survey. It contained (1918) 42 head of buffalo, 90 head of elk and a small herd of antelope.

WIND-FLOWER, the delicate *Anemone nemorosa*, *A. quinquefolia*, and other members of this genus of the *Ranunculaceæ*, so-called because the ancient Greek name of some plant associated in Greece with the winds has been given to the *Anemone*, or because the little plants bloom when spring winds are rampant. The two species mentioned send up an early flowering stem, bearing about its centre a whorl

Report on Diseases of the Horse' (United States Bureau of Animal Industry, Washington 1911).

WINDHAM, wĭn'dăm, **William,** English orator and statesman: b. London, 3 May 1750; d. there, 4 June 1810. He was educated at Eton, Glasgow and Oxford, and he entered Parliament as member for Norwich in 1784. During the early part of Pitt's administration he sat in the opposition, but during the course of the French Revolution joined Burke in condemning the revolutionary principles and advocating the war that Pitt declared against France. He was Secretary-at-War in Pitt's Cabinet 1794–1801, and under the Fox and Grenville ministry, which came into office in January 1806, held the rank of Colonial Secretary. During his tenure of office, which continued till March 1807, he brought in and succeeded in passing against strenuous opposition, a measure for reducing the duration of the period of enlistment for soldiers, and making various provisions for improving the condition of the soldier. Windham was a man of thoroughly independent character, but his independence sometimes passed over into eccentricity. A collection of his speeches with a memoir by Thomas Amyot was published in 1806, while he was yet in office; his diary was edited by Mrs. Henry Baring in 1866. Consult also 'Correspondence of Edmund Burke and William Windham' (ed. J. P. Gilson, Cambridge 1910); 'The Windham Papers' (2 vols., London 1913).

WINDHOVER, a name in Great Britain for the kestrel (q.v.), referring to its habit of holding a stationary position facing the wind, while it searches the ground beneath it for indications of prey.

WINDHUK, WINDHOEK, or **GREAT WINDHOEK,** Africa, city and capital of the former colony of German Southwest Africa, 170 miles east of Swakopmund and the coast, with which it is connected by rail and telegraph. The city is situated in a mountainous district, and at Little Windhuk, a short distance to the southwest, there are hot springs. It is an excellent fruit-growing region and produces grapes, figs, dates, peaches, oranges and pomegranates. It was occupied by the South African Commonwealth Army under the British flag 12 May 1915. The population is about 25,000, of which about 1,500 are whites. See WAR, EUROPEAN — COLONIAL AND JAPANESE CAMPAIGNS.

WINDLASS, in mechanics, a machine for raising weights from a pit, consisting of a cylinder or roller moving on an axle supported on a frame and turned by levers inserted in square holes cut in the cylinder, or by a crank fitted on to one or both ends of the axle. One end of a rope or chain is attached to the cylinder, and the other to the weight, which is raised by the rope being shortened in passing round the roller.

WINDLE, Sir Bertram Coghill, Irish educator: b. Mayfield, Staffordshire, 8 May 1858. He was educated at Repton School and at the University of Dublin. For four years he was president of the Birmingham Library and at various times was member of the education sub-committee of the Birmingham School Board. Dr Windle is a member of the Joint Universities Catholic Board and from 1884 to 1904 was professor of anatomy and for many years dean of the medical faculty of Birmingham University and bodies which preceded it. Since 1904 he has been president of University (formerly Queen's) College, Cork and since 1910 has been professor of archæology there. He is also senator of the National University of Ireland and chairman of the standing committee on Irish Technical Education and Commissioner of Intermediate Education in Ireland. In 1912 he was knighted. His publications include 'Proportions of the Human Body' (1892); 'Life in Early Britain' (1897); 'Shakespeare's Country' (1899); 'The Malvern Country' (1900); 'The Wessex of Thomas Hardy' (1901); 'Chester' (1903); 'Remains of the Prehistoric Age in England' (1904); 'School History of Warwickshire' (1906); 'What is Life? A Study of Vitalism and Neo-Vitalism' (1908); 'Facts and Theories' (1912); 'A Century of Scientific Thought' (1915); 'The Church and Science' (1917), and many scientific papers and articles in *Dublin Review, Catholic World, America,* and *Studies.*

WINDMILL, a machine for furnishing power for grinding grain, pumping water, or doing other useful work, operated by the wind. History does not record the date of invention of the windmill; but it is known that it was used in Europe as early as the 12th century AD. A common form of European windmill is shown in Fig. 1. The sails, upon which the wind

FIG 1

acts in driving the machine, consist of a light framework upon which canvas is stretched. The surface of the canvas makes an angle (called the angle of weather) with the plane of the windwheel, and this angle is usually about 18° at the inner end of the sail, gradually decreasing to about 7° at the outer end. The length of the sail is generally about five-sixths the length of the arm, the width of the outer end one-third the length, and the width of the inner end one-fifth the length. For proper

cipally of wood, others entirely of metal. Each is, however, designed automatically to maintain the windwheel in its proper relation with the direction of wind, to deliver the power developed either by means of a rotating shaft or reciprocating rod, and automatically to keep its speed below a certain definite and safe limit. A certain number of methods have been devised for each of these operations. Different

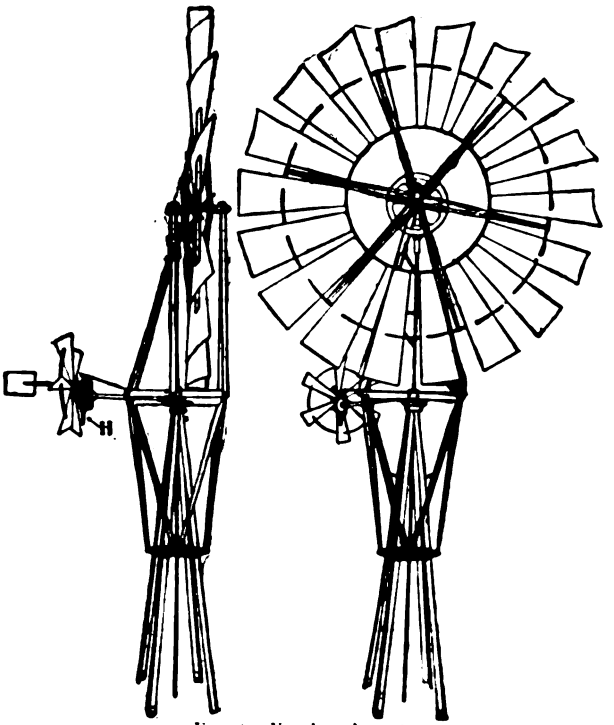


Fig. 4.—Vaneless Airmotor.

combinations of these methods, together with variations in minor details, result in the large variety of styles. Figs. 2, 3 and 4 show several windmills of the American type, these particular forms being selected because among them may be found examples of each of the methods by which the results before mentioned are accomplished. The windwheel may be held in proper position with regard to the direction of wind in three ways, namely, by means of a rudder or tail, as in Figs. 2 and 3, by means of an auxiliary steering wheel, as in Fig. 4; and by the pressure of the wind upon the windwheel itself, which is placed on the opposite side of the tower to that from which the wind proceeds, as in Fig. 4. When the windmill is to be used for pumping purposes exclusively, the power is, in general, transmitted from the windmill to the pump by means of a reciprocating vertical rod, as in Figs. 2 and 3. Those in which the pump rod makes one complete stroke for each revolution of the windwheel, as in Fig. 4, are termed direct stroke windmills; when the pump rod makes only a fraction of a stroke for each revolution of the windwheel, as in Figs. 2 and 3, the windmill is said to be back geared. The back gearing may be accomplished either by means of a pair of spur gears, as in Fig. 2, or by means of a rack and pinion, as in Fig. 3. In pumping windmills of recent construction back gearing is very largely employed, its object being to avoid the great shocks and violent churning of the water resulting from the rapid action of direct stroke windmills, and to reduce the losses in the pump due to friction and to backlash of the valves. When the windmill is to be used for general power purposes, which may include pumping, sawing, grinding, etc., the power is transmitted through a train of gears to a vertical shaft, those of this general type being known as geared, or power windmills. Any torque exerted by the gearing upon the vertical shaft reacts upon the windmill itself, tending to rotate it out of its normal position with regard to the direction of wind. Neglecting friction, the torque at the vertical shaft is equal to that exerted by the windwheel divided by the number of turns which the vertical shaft makes to one turn of the windwheel. Hence the effect of the vertical shaft in disturbing the position of the windwheel becomes smaller in amount as the ratio of gearing between them is increased, and for this reason the ratio of gearing is in best practice made about six to one; that is, the vertical shaft makes six revolutions to one revolution of the windwheel. This high ratio is also an advantage in that it allows the diameter of the vertical shaft, for a given size of windwheel, to be made considerably less than that which would be necessary with a smaller ratio.

When the pressure of the wind upon the windwheel becomes so great as to approach the danger point, it is lessened by reducing the sail area exposed to the wind. In the windmill shown in Fig. 2 the windwheel is so placed that a line drawn through its centre parallel to the normal direction of the wind passes to one side of the axis about which the windmill pivots. The tail is in each case supported upon the windmill frame by the hinge joints, C, C', and is held in its normal position with reference to the windwheel by the spring D. Wind-pressure upon the windwheel tends, therefore, to stretch the spring, and it does so when it is sufficient to overcome the initial tension of the spring, thus turning the windwheel so that the wind acts obliquely upon it and reducing the exposed sail area. The initial tension of the spring is so determined that it will begin to stretch when the pressure of the wind upon the windwheel approaches the safe limit. In the windmill shown in Fig. 3 the windwheel is so placed that a line through its centre parallel to the normal direction of the wind intersects the axis about which the windmill pivots. The side vane E is fixed to the windmill frame, upon which the tail is also carried, being supported by the hinge joints, C, C'. The tail is held in its normal position with reference to the windwheel by means of the spring F. Pressure of the wind upon the vane E tends, there-

turns which a windwheel will make in a given time varies inversely as its diameter. (6) There is nothing gained by having the sail area of a windwheel greater than seven-eighths of the area swept by the sails, and there is little gained by having it more than three-fourths the latter area.

In order that the maximum power may be fore, to stretch the spring F, and the spring is so determined that it will be stretched when the wind pressure upon the vane E approaches the is evident that any change in the relative position of the windmill is changed so that the exposed sail area is reduced, in the same manner as with the windmills shown in Figs. 2 and 3. In the windmill shown in Fig. 4 it is evident that any change in the relative positions of the steering wheel and the main windwheel will result in a change in the position of the latter relative to the wind. The frame carrying the steering wheel is pivotally mounted upon the frame which carries the main windwheel, and is held in its normal position with reference to it by the coiled spring H. In the ordinary running position the wind falls perpendicularly upon the side of the tail of the steering wheel, and when the pressure upon it exceeds the safe limit it overcomes the resistance of the spring and changes the position of the steering wheel so that the wind falls upon its face; this causes the steering wheel to act, which moves the main windwheel so that the wind falls obliquely upon it, thus reducing the exposed sail area. Other methods of regulation, involving centrifugal governors or variations from the arrangements above described, have been devised, but have not come into extended use. The particular mechanical details involved are subject to very wide variation, but the arrangements shown in the figures serve to illustrate the principal types.

Windmills of the usual forms are, in general, mounted upon towers of heights ranging from 10 to 100 or more feet, so that the wind which acts upon them will not be seriously affected by obstructions which may exist in their immediate neighborhood. Provision is always made for controlling, or furling, the windmill from a convenient place near the base of the tower, generally by means of a wire, termed the furl-wire. Furling is in general accomplished by reducing the exposed sail area to such an extent as to prevent the action of the windmill. The reduction of the exposed sail area is in each case accomplished in the same manner as in the process of regulation, except that the force necessary to lift the weight or overcome the tension of the spring is applied through the furl-wire and transmitted by a suitable arrangement of levers or pulleys, instead of being supplied by the energy of the wind. Thus in the windmills shown in Figs. 2 and 3 a pull transmitted through the furl-wire is applied to the tail in such manner as to bring it into a position parallel to the plane of the windwheel. In that of Fig. 5 the auxiliary wheel is turned through an angle of 90 degrees by means of a pull on the furl-wire. It is to be observed that in each of the windmills heretofore mentioned the windwheel is adapted to rotate about an axis the normal position of which is parallel to the direction of the wind. A number of types of windmills have been devised in which the windwheel rotates about an axis, the normal position of which is in a plane perpendicular to the direction of the wind, but they have not attained a sufficient degree of success to warrant considering them here. If A represents the plane area, in square feet, swept by the sails of the windwheel, V, the velocity of the wind in feet per second, and δ the weight in pounds of a cubic foot of the air, then the weight of air available per second for use by the windwheel is $W = AV\delta$, and its energy is equal to $\frac{WV^2}{2g}$, g being a constant representing the acceleration due to gravity. The power in foot-pounds per second brought to the windwheel by this air is, therefore, $L = \frac{WV^2}{2g} = \frac{V^3A\delta}{2g}$. This expression indicates that, other conditions remaining the same, the power of a windwheel varies directly as the cube of wind velocity, and directly as the area swept by the sails, both of which relations have been substantially verified by experiment. In the construction of windmills considerations of strength require that, in general, the linear dimensions of all of the parts shall bear the same proportional relation to each other, regardless of the size of the windwheel. Other conditions being equal, the weight of a windmill, therefore, varies directly as the cube of the diameter of its wheel, while its power varies directly as the square of the diameter of the wheel. Hence, in increasing the size of windmills, the weight, and the consequent cost of material, increase more rapidly than the capacity, and it is not, therefore, found practicable to increase their size beyond a certain degree. When a windmill is in operation the air currents which act upon it are so modified and broken up, by their contact with the sails and other members, as to render accurate mathematical treatment of the case impossible, in the present state of our knowledge. For this and other reasons, mathematical considerations of the case are chiefly of theoretic interest and the development of the form of the windwheel has been due rather to experiment than to theory.

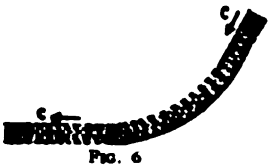


FIG. 6

The most notable among the experiments which have been made upon windwheels are those made about the middle of the 18th century, upon windwheels of the European type, by John Smeaton, and those made in 1882 upon windwheels of the American type by Thomas O. Perry. In these experiments the following important facts were, among others, established: (1) The maximum power which may be obtained from a given windwheel varies directly as the cube of the wind velocity. (2) The sail speed of a windwheel, when developing its maximum power, varies directly as the wind velocity. (3) The load upon a windwheel, when developing its maximum power, varies directly as the square of the wind velocity. (4) The capacity of a windwheel varies directly as the square of its diameter. (5) The number of

obtained from a windmill, in winds of varying velocity, the load must vary directly as the square of the wind velocity. In practice the load is seldom, if ever, made to vary in this manner. The most common form of installation is that in which a pumping windmill is directly connected to a single acting pump operating under a constant head. In such cases the average load during a complete cycle of the pump is practically constant regardless of the wind velocity. Moreover, the load varies, in general, from about zero during one stroke to a maximum at about the middle of the other stroke. This periodic variation of load is also a source of loss, especially when the windwheel is rotating slowly, and the amount of kinetic energy stored in it is small. In the case of

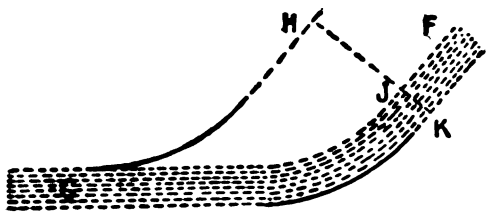


FIG. 7.

power windmills the load depends upon the character of the work. Some grain-grinders for use in connection with power windmills are constructed so that the grain is fed to them by centrifugal action, and in these instances the load upon the windmill is made to increase as the speed increases.

Consult Barbour, 'Wells and Windmills in Nebraska' (Washington 1899); Murphy, E. C., 'The Windmill: Its Efficiency and Economic Use' (in United States Geological Survey, Water Supply and Irrigation Papers, Nos. 20, 29, 41, 42, Washington 1899–1901); Powell, F. E., 'Windmills and Wind Motors: How to Build and Run Them' (New York 1910); Dyer, R. M., in *Machinery* (August 1907); Wolff, A. R., 'The Windmill as a Prime Mover' (New York 1885); also manufacturers' catalogues and in works on farm equipment and farm motors, machinery, etc.

WINDOM, win'dŏm, William, American financier: b. Waterford, Ohio, 10 May 1827; d. New York, 29 Jan. 1891. He was admitted to the bar in 1850, engaged in law practice at Mount Vernon, Ohio, and in 1852 was prosecuting attorney of Knox County, Ohio. He held this position for three years, when he removed to Minnesota. Sent to Congress from that State in 1859, he was re-elected to serve four successive terms, a period of 10 years, ending his career in the House in 1869. He was appointed to the United States Senate in 1870 to fill the unexpired term of Daniel S. Norton, deceased, and was also elected for the terms ending in 1877 and 1883. He resigned, however, in 1881, to accept the Treasury portfolio in President Garfield's Cabinet, and on his retirement from the Cabinet after that President's death he was returned to the Senate where he served the remainder of his term. He was occupied with various financial interests in New York from 1883–89, when he was appointed Secretary of the Treasury in President Harrison's Cabinet and occupied that position until his death. He was one of the earliest exponents of the gold standard, and was considered available as a Presidential candidate in three national conventions, those of 1880, 1884 and 1888.

WINDOW, an open space reserved, as in a wall, for the admission of daylight into the interior. (See also DORMER WINDOW). The window generally is in a vertical wall. The opening may be filled with glazed sash or casement arranged to open and shut, as in the modern houses; or with glazed sash of wood, iron, or lead fixed firmly to the solid frame of the window, or with only a single panel here and there made to open, as in the case of churches both ancient and modern; or the space may have a slab of semi-transparent stone let into it through which much light may enter, as in some Oriental and ancient European buildings; or a slab of marble with holes cut in it may be inserted, or in place of this a continuous grating, as of bronze, both of which were frequent in classical Roman buildings; or, finally, the space may be left without permanent filling of any sort, shutters being used to close it when needed, as in many parts of Europe in the Middle Ages, and as common now in the tropics. Still a further modification of the last-named scheme is found in those tropical houses which have all the openings filled with *jalousies*, namely, shutters with slats (louver shutters), some of which may even be fixed fast, while others open on hinges. As the climate becomes too warm for the necessity of closing the windows at any time in the year, these devices tend to replace solid shutters and casements.

Architecturally the window is of the greatest importance to certain styles, and in others does not count at all. Thus in Grecian architecture there are no windows; and in Greco-Roman architecture the window has never been a controlling member because the great windows of the public halls are commonly the lunettes under the vaulting, simply pierced and filled with gratings instead of built up solid with masonry. The window of the ancient Roman dwelling, also, so far as we know it, was of less consequence because there were no openings of any great size in the outer walls, and the rooms opening inward upon the court or garden were more or less without walls on that side, a large doorway and a square window above the bed-place needing nothing but a curtain or the like to screen them. Even in Byzantine and Syrian art the window, though beginning to be emphasized by a stone trimming or casing, is not that which the style depends upon. But in the mediæval styles of northern and western Europe the window is the chief feature after the roofs with their fixed slope and their height above the walls. The earliest Romanesque had windows, small indeed, but with jambs richly molded in the thickness of the heavy walls; and the later style takes on some of the variety and brilliancy of the Gothic work. The Gothic window in a church is the opening up of the whole wall space between buttress and buttress and below the vault; and this space tends to be filled with elaborate tracery. Even apart from the tracery, the moldings of the jamb – often with colonnettes produced by fitting a round molding with capital and base, and with sculpture added to the sill-course – may be very decorative. In dwelling-houses

tracery was rare, but the window, if large, was closed with a pointed arch and the head filled with a slab of stone pierced with a decorative opening and supported by colonnettes, or in some other way architecturally treated. The very numerous windows with square heads, that is, with lintels instead of arches, are made ornamental by moldings, sometimes very rich and elaborate, and by the free use of colonnettes to carry the lintels. In the neo-classic style a curiously regulated and ordered system of arranging the windows became customary in the early days of the Renaissance, and was completely developed in the 16th century in Italy, and 50 years later in the north. Under the name of fenestration this ordering of the windows has become a most important part of designing, especially in the street fronts of city buildings. The window-casings may even be ornamental in themselves, though with an ornamentation not strictly belonging to them, but borrowed, as it were, from other parts of the structure: thus, small pediments are used to crown the window openings, and even columns are used one on either side of the window opening, to support these pediments. But the main thing is still the arrangement of the windows in the wall and the proportioning of these openings and the solid wall between them.

WINDOW GLASS. See GLASS, VARIETIES OF

WINDOW TAX, a tax formerly imposed in Great Britain on all windows in houses (latterly above six in number). It was abolished in 1851, a tax on houses above a certain rental being substituted.

WINDSOR, wĭn'zor, Canada, a seaport town, capital of Hants County, Nova Scotia, on an inlet of Minas Bay, and on the Dominion Atlantic Railway, 45 miles northwest of Halifax. Its chief institution is King's College (q.v.), or Windsor University, founded in 1788. It is a busy shipping port, is electrically lighted, and has a considerable export trade in the gypsum and limestone of the region. Pop. 3,452.

WINDSOR, Canada, the largest town in Essex County, situated on the banks of the Detroit River, opposite the city of Detroit. Five railways enter the city, including the Grand Trunk, Canadian Pacific, Michigan Central, Wabash, and the Ontario division of the Pere Marquette. The location makes Windsor one of the desirable residential cities of the continent. It has a number of churches and schools, a collegiate institute and Saint Mary's Academy. The chief manufactories are salt works, paint and varnish works, sash, door and planing factories, boiler works and machine shops, with various minor industries. It has several miles of paved streets and an adequate sewerage system. Pop. 17,829.

WINDSOR, Conn., town in Hartford County, on the Connecticut and Farmington rivers, and on the New York, New Haven and Hartford Railroad, six miles north of Hartford. It is in an agricultural section in which the chief products are vegetables, fruit and tobacco. The principal manufactures are worsted goods, paper, electrical motors, knit goods, tobacco products and dairy products. The educational institutions are the Campbell School for girls, the Loomis Institute, public schools and a public library. The first settlement was made in 1633 by William Holmes and companions from Plymouth. They established here a trading post. In 1635 Roger Ludlow and a colony from Dorchester, Mass., settled near the trading post and called the place Dorchester. In 1637 the name was changed to Windsor. In 1639 Windsor united with Hartford and Wethersfield, under "Fundamental Orders," to form the commonwealth of Connecticut. Pop. 4,178. Consult Stiles, 'Ancient Windsor' (New York 1891); 'Memorial History of Hartford County.'

WINDSOR, or **NEW WINDSOR,** England, a town in Berkshire, on the Thames, 21 miles by rail west of London. Windsor and Eton (q.v.) practically form one town, which is chiefly interesting on account of the castle and park, a favorite residence of the English sovereigns since the time of William the Conqueror. The original royal palace, where the Saxon kings lived before the Conquest, was at Old Windsor, about two miles distant, but the present site was chosen and the castle built by William; later extensions were added by Henry I and Henry II, but during the reign of Edward III it was torn down and rebuilt by William of Wykeham, bishop of Winchester. The new castle received various additions by the orders of succeeding monarchs until the time of Queen Victoria, who restored and sumptuously decorated Albert chapel as a memorial to the Prince Consort, Albert. The buildings comprise upper, lower and middle wards, extending along the crest of an eminence rising 42 feet above the river and covering 12 acres in the Little or Home Park, which is connected with the Great Park and adjoining Windsor Forest, the whole occupying an area of 13,000 acres, 56 miles in circumference. The lower ward on the west contains Saint George's chapel, the Albert chapel, the houses of the military knights, cloisters, etc.; the Middle Ward, dominated by the Round Tower, rising to a height of 80 feet, built by Edward III to accommodate the round table of the Knights of the Order of the Garter, containing the rooms which were up to 1660 used as a prison; the Upper Ward on the east, comprised of the sovereign's private apartments, the library and the long corridor. Saint George's Hall, the Waterloo Chamber, the Throne Room and the old Ball Room, comprising the state apartments in the Upper Ward, have valuable collections of paintings, statuary, etc. Under Saint George's chapel is the burial vault of several English rulers and members of the royal family. The royal palace and the mausoleum of Frogmore, Cumberland Lodge and Virginia Water are in the park. The town hall of Windsor was built by Christopher Wren in 1658. Consult Dixon, W. H., 'Royal Windsor' (London 1879-80); Hope, W. H., 'Windsor Castle: An Architectural History' (2 vols., London 1914); Laking, G. F., 'Furniture of Windsor Castle' (New York 1905); Loftie, W. J., 'Windsor: The Castle, Park, Town and Neighborhood' (London 1886); Tighe, J. E., 'Annals of Windsor' (1858).

WINDSOR LOCKS, Conn., town in Hartford County, on the Connecticut River, and on the New York, New Haven and Hartford Railroad, about 12 miles north of Hartford. It was a part of the town of Windsor until 1854,

of the Bible was a vat in which the juice was expressed by the feet of men who trampled the fruit.

WINE AND WINE-MAKING. It may have been design, but it was probably an accident, that first led man to crush or to press grapes in order to obtain a palatable and stimulating beverage. As long as the juice is confined within the grape, it becomes sweeter and sweeter as the fruit grows riper and riper. But when the skin is broken by crushing or pressing, and when the juice is allowed to remain a short time exposed to warmth and air, it changes its character and develops new and unsuspected qualities or properties.

The changes from the fresh grape juice to an alcoholic drink are briefly as follows:

When the juice, or "must," is exposed to temperatures ranging from 59° F. to 65° F. the liquid very soon begins to become turbid, small bubbles collect on the surface and the grape skins, stems and other solid particles form a dense cover or "cap" on the top. Carbonic gas, which is developed in increasing quantities, escapes with a loud bubbling sound, and, as the temperature rises, the juice appears as though it were really boiling. After a few days, and sometimes after a few hours, the ebullition subsides and gradually the crust and undissolved substances fall to the bottom. Meanwhile, the must has lost its sweetish taste and its original character and chemical composition; among other things, it has acquired a richer, deeper color, a vinous flavor and odor, and a certain amount of alcohol.

This interesting natural process, which leads to the formation of alcohol, was described by the term "fermentation," from the Latin *fermentum*, the root word being *fervere*, to boil. This feature of the phenomena, whereby the evolution of the gas makes the liquid appear to boil, evidently struck the early wine-makers and natural philosophers as most important. It was a long time before the true nature of the process of vinous or alcoholic fermentation was clearly perceived and properly understood.

Early in the last century (from 1810–25) chemical analyses by Gay-Lussac, Thénard and De Saussure fixed accurately the composition of sugar in the must and of alcohol in the wine. In 1835 Cagniard de Latour found that the globules were definite organisms, capable of reproducing themselves by budding, and thus apparently belonging to the vegetable kingdom. He came to the conclusion that, in the course of vegetation, these globules, or "ferments," disengaged carbonic acid gas and converted the liquid into an alcoholic liquor.

This discovery was confirmed two years later (1837) by Schwann at Jena and Kutzing at Berlin. The newly-found organism was regarded by some as belonging to the fungi and by others to the algæ. Meyen showed that the organism was a fungus and established a new genus for it under the name of *Saccharomyces*. In other words, the agents of alcoholic fermentation are called "yeasts" and belong to the order *Saccharomyces*.

Recent Researches in Alcoholic Fermentation.— The work of the great chemist Pasteur threw a flood of light upon the whole process of fermentation. His investigations extending over a series of years were first summed up in his 'Studies on Wine' ('Etudes sur le Vin'), published in 1872, and further in his book, 'Studies on Beer' ('Etudes sur la Bière'), published in 1876.

To Pasteur belongs the honor of establishing beyond question that fermentations were the work of infinitely small organisms called "microbes." He classified and described many of these micro-organisms. He divided them into two classes: aerobic, those which cannot live without the presence of free air; and anaerobic, those which can exist in the absence of air. The former saccharomyces are found at or near the top of the liquid during fermentation; the latter are at work lower down in the body of the liquid.

The microscopical examination of the agents of alcoholic fermentation has revealed quite a number of different forms and varieties. Some 25 or 30 types of the genus *Saccharomyces* have been identified.

The question may very naturally be asked: Where do these yeast organisms come from? Pasteur showed very clearly that the ripe grape is covered with a mass of micro-organisms. These microbes collect on the fruit and stems, and consitute the "bloom" of the grape. Just why they should fix themselves on the fruit, and remain, as it were, in readiness to be transformed from their dormant state to one of great activity when carried into the juice of the fruit is a mystery. At the same time a great number of other and less desirable yeast cells (bacteria) become submerged in the grape juice, or must, and these foreign yeasts are the ones that give the wine-maker trouble and lead to many diseases of wine.

Cultivated and Selected Yeasts in Wine-making.— A brilliant Danish chemist, Emil Chr. Hansen took up the study of alcoholic fermentations and "disease ferments," where Pasteur left off. He brought out many new facts with regard to the many different races or species of *Saccharomyces*, which gave very different characters to beers. Hansen found that it was practical to separate and cultivate the better species or races of brewer's yeasts. With great skill and much care he was able to select two varieties of "low" yeast and then he worked out a method for the cultivation of selected yeasts.

The use of pure cultivated yeasts has been attended with good results in wine-making. Musts which have been prepared with pure yeasts have been compared with musts fermented at the same time without such yeast. In most cases the pure-yeast wine has been regarded as superior to the other. One practical value of employing pure cultivated yeasts in wine-making is that under proper conditions they will control the progress of fermentation, and thus overcome the influence of the undesirable organisms in the must, such as mold-fungi, wild yeasts, bacteria and mycoderma. By using selected yeasts from celebrated vintages, wine-makers have been able to obtain finer flavors and bouquets, all of which adds to the quality and value of their product.

Fermentation and Enzymes.— In order to grasp and properly understand the various problems connected with the phenomena of fermentation, it is necessary to say something about its relation to enzymes. The term "enzyme" is now used to indicate the *soluble* ferments

secreted or formed in the yeast cell. Pasteur's theory makes fermentation a vital act, depending on a living organism. However, fermentation may also be a chemical act. About 20 years ago Büchner showed that alcoholic fermentation can be carried out by a soluble ferment which is extracted from the yeast cell. So that we can have the phenomena of fermentation without the growth and multiplication of yeast cells. To this enzyme in the yeast extract Büchner gave the name *zymase*.

The effect of these recent discoveries in fermentation may be very great and far-reaching, and just what practical form they will take in wine-making and other industries it is impossible to predict.

The Vintage.— The word "vintage" has come to have quite a wide signification. It may be used to include three distinct steps: (1) the gathering of the grapes; (2) the processes of fermentation, and (3) the general cellar operations connected with the care and handling of the new wine.

The practices of wine-makers are different in different countries and in different localities of the same country. This is owing to difference in soils, climates, conditions, varieties of grapes used, and in the kinds or types of wines to be produced. And yet, the main principles which give the best results in practice in one country are practically the same in any other country where wine is made.

It should be borne in mind, however, that wine-making is partly an art and partly a science. As such, it cannot be learned and mastered by reading, or from books. The best we can here do is to describe briefly some of the more important details connected with the manufacture of wines.

Gathering of the Grapes.— The general rule is that grapes should not be gathered till they have reached a state of complete maturity. This condition is shown by certain well-known indications, such as the brownish color of the stem, the softening of the berry and its easy separation from the stem, the skin is translucent, the juice becomes sweet, thick and somewhat sticky.

The wine-maker determines the best time for gathering the grapes by using various instruments, known as a must-scale, mustimeter, glucometer, etc. They are employed for the purpose of finding out the saccharine richness or strength of the grape juice, or must. To judge of the sugar content of the grapes a few bunches representing the average condition are first gathered, the juice is expressed and strained through a cloth, collected in a suitable receptacle, and then the must-scale is carefully dropped into it. The quality of the must will be indicated on the stem of the scale. The grapes should be tested from day to day until the density, as shown on the scale, remains stationary, when it is time, as a rule, to gather the crop.

The oldest scale, that of Baumé, was devised to indicate the specific gravity of liquids, or their weight, as compared with that of water. Later scales give the density of the liquid direct, the density of water being indicated by 0. The glucometer invented by Dr. Guyot is very convenient and is used by the French wine-makers. This scale indicates at once, the degree Baumé, the quantity of sugar in the must per hectoliter, and the amount of alcohol that will result from the fermentation of the must per hectoliter The Salleron mustimeter is another very useful instrument, highly regarded by French wine-makers. The instruments mostly used in the United States are Oechsle's must scale and Balling's saccharometer. The must scales are also used during fermentation to determine when the sugar contained in the must has been partially or entirely transformed into alcohol.

Composition of the Must.— A very good idea of the qualities of a good, average must may be gained from the following table prepared by Dr. Guyot:

Water	78
Grape sugar (glucose)	20
Free acids (tartaric and tannic, etc.)	0 25
Bi-tartrate of potash	1 50
Mineral salts	0 20
Albuminous substances, Essential oils, Mucilaginous and starchy substances	0 05
Total	100 00

It should be pointed out that these different ingredients are not always in the same proportion; that some of them may rise to double the average quantity above given, or may fall, in some cases, to one-fourth of it. In brief, the composition of the must varies according to the variety of grape, degree of maturity, kind of soil, climate, etc.

After water, grape sugar or glucose is the most important element of the must. By the agents of fermentation it is transformed principally into alcohol and carbonic acid. This transformation is represented by the following chemical formula:

$$C_6H_{12}O_6 = 2C_2H_6O + 2CO_2$$

Grape sugar. Alcohol. Carbonic anhydride.

There remains a very small proportion of glycerine and succinic acid, and matters dissolved in the liquid. According to Pasteur, 100 parts of glucose yield through fermentation: Alcohol, 48.46; carbonic acid, 46.67; glycerine, 3.20; succinic acid, .61, and other substances left, 1.03

The organic acids and acid salts, while they exist in very small proportions, have great influence on the course of fermentation and the quality of the product. The must of grapes picked too soon will contain an excess of acids and a corresponding lack in sugar; while in overripe grapes there will be much sugar but a deficiency in acids. Therefore, wine-makers endeavor to correct such imperfections by watering the must, or by adding sugar, or by adding tannic or tartaric acids, etc. To determine the acidity of must, several instruments, or acidimeters, have been invented. Most of them require considerable skill and knowledge to be properly used, but the Dujardin acidimetric Tube will answer for all practical purposes.

The other substances contained in the must — albuminous matters, etc.— contribute to the formation of extractive matters, after having served to feed the yeast organism.

Vinification.—The French word "vinification" is a convenient and common term used to cover the details of wine-making. The special treatments of the must result in different kinds of wines

Thus, we have two distinct classes: (1) "dry" wines, and (2) sweet wines.

Dry wines are those in which the sugar has been fermented out.

Sweet wines are those which, after their active fermentation, still retain a quantity of sugar. Many of the sweet wines are fortified by the addition of brandy.

Wines are often classed as "still" and "sparkling."

Still wines are those in which the carbonic acid gas has wholly escaped. Sparkling wines are those which hold a greater or less amount of carbonic acid gas.

It is useful and convenient to make two classes, namely (a) red wines, and (b) white wines. Red wines are produced from red or other colored grapes, the color being extracted from the skins during fermentation. The coloring matter is purplish blue, but is changed to red by the acids in the must. White wines are produced from both white and colored grapes. In order to avoid dark color, the must is quickly separated from the skins and other solid parts of the grape. The following is briefly the method of vinification of red wines:

Crushing.— The ancient method consisted in tramping the grapes with the bare feet or with heavy boots in a big trough from which the juice ran as it was expressed. While this old-fashioned method still obtains in a few districts in Europe, it has been superseded there and in the United States by machines, which are called "crushers." There are several kind of mechanical crushers, but the type most generally used consists of a hopper beneath which revolve two grooved cylinders.

The grapes when dumped into the hopper are then crushed between the rollers, which only break the skins without crushing the seeds. They next pass into the stemmer.

Stemming.— Formerly done by hand, or by a rake over a sieve or screen, the stems are now removed by machines in a very ingenious manner. The grapes after passing through the crusher fall into the stemmer. The stems are carried to one end of the machine, where they are discharged; the seeds, skins, pulp and juice escape through the bottom, and are conveyed by chutes into the fermenting tanks, which are usually on the floor underneath.

Stemming has its advocates and opponents. The advantages claimed for stemming are that it facilitates the free access of air and so helps the fermentation, especially in case of damaged vintages; that stemmed wines have more *finesse* and are more alcoholic than wines from unstemmed grapes. In the south and southwest of France wine-makers seldom stem their grapes. As a rule grapes are stemmed in the leading wineries in our Eastern States and in California.

Fermenting Tanks or Vats.— These are generally made of oak, although in California redwood has been generally adopted. The capacities of fermenting tanks vary from 1,000 to 10,000 gallons.

There is a difference of opinion among wine-makers as to whether the must should be fermented in open or in closed vats. For open vats it is claimed that the fermentation is generally more rapid and complete, the wine is better colored, etc. Against the open vat, it is urged that the exposure to the air transforms the alcohol in the "head" or cap, which is raised to the top by fermentation, into acetic acid and thus injures the wine. An easy way to overcome this objection is by having a false head resting on the cap, and thus keep it submerged during the fermentation. The best practice would seem to be in having a submerged head fermentation.

Duration of Fermentation.— This depends on a number of conditions, such as the amount of sugar in the must, the activity of the ferments, the temperature of the vat, etc. It may be completed in two or three days, or it may run on for 15 or 20 days.

Three distinct phases of fermentation will be observed: (1) the first day or two when the ferments are multiplying; (2) the tumultuous fermentation, accompanied by a violent bubbling of the liquid and a rise in temperature, and (3) the active but relatively quiet fermentation.

As a general rule, the more rapid the fermentation the better is the result. In the Southern States and in southern California the process may be completed in one or two days. In the northern or temperate climates the time will run from seven to ten days.

The Influence of Temperature.— As we have already indicated, temperature exerts a controlling influence on fermentation. The yeast works best in temperatures ranging from 59° F. to 75° F. Below 59° its action is very feeble and slow; above 75° fermentation becomes retarded and even stops if the temperature passes much above 90°.

Thus, wine-making both in very hot and in very cool climates often presents many difficulties to be overcome. The must frequently becomes what is called "stuck" — that is, fermentation ceases before all the sugar is transformed into alcohol.

If the trouble comes from too low a temperature, the remedies are: (1) To raise the temperature by heating part of the must; (2) to heat up the fermenting room; (3) to increase the activity of the yeast by adding sediment from vats already through fermentation, and (4) to stir up the pomace so as to bring the germs in contact with the air, as the yeast is always "greedy for oxygen."

When the temperature of the must in the vats rises too high, it is necessary to lower the temperature in one way or another. Several methods are employed for cooling the must. Among these we may mention the use of shallow vats, racking off and refrigerating systems. The difficulties of wine-making in our Southern States and in southern California can be overcome only by the adoption of a suitable system for cooling musts.

The success of the wine-maker will always depend on his success in being able to control the progress of fermentation. Therefore, he should be able to control the temperature, which during fermentation has a most important influence (1) on the yield in alcohol, (2) on the qualities of wine, and (3) on the keeping quality of wines.

Drawing off the Wine.— Active fermentation can be recognized as being over, by the falling of the temperature, the settling down

of the solid mass or marc, by the clearing of the liquid and the vinous taste and smell. The new wine will show from 0° to 2° by Balling's saccharometer, nearly all the sugar having been transformed into alcohol. It is either run into a large tub and emptied into casks or it is pumped into casks. The drawing off of the new wine leaves in the vat the "marc," which still contains a considerable quantity of material that can be made into an inferior wine.

The Different Wine Presses.— It is not necessary to enter into a detailed description of the different forms of wine presses. They work by a screw or by hydraulic pressure and they are operated by hand, steam and electric power. Where grapes are handled on a large scale, as in some sections of France and California, continuous presses of recent invention are used. These are composed of two or more cylinders, worked as crushers, and after passing through these cylinders the grapes are carried by a screw, which forces them in a perforated horizontal cylinder, terminating in an orifice through which the marc in a compact cake is expelled. Even the improved types of presses are not perfect as far as the yield or quantity of wine is concerned. Recent experiments show that the residue of the marc can be exhausted without presses by a process called diffusion.

The first run from the press is of course the best. The second and third pressings are inferior and seldom mixed with the other wine; the last run is used for making brandy or vinegar.

Utilization of the By-Products.— From the husks and lees are obtained the following products: "piquettes," brandies and tartar. Second wines are produced by adding water to half the amount of the wine already drawn off, sufficient sugar to give from 6 to 7 per cent of alcohol and tartaric and tannin when acidity is needed. The piquettes are thin, sour wines obtained by adding pure water to the marc, before or after pressing; the cask is filled and closed. In course of time a wine having from 3 to 4 per cent of alcohol is produced, but it will not keep long. This is the cheap but healthful drink so largely consumed by the peasants and working people in France.

Brandies.— They are obtained either by distilling the marc direct or by the distillation of a piquette wash. The best kind of brandy of the Cognac type is produced by distillation of a sound, clean wine. This process of distillation requires improved stills and special treatment. The "wash" for brandy spirits is obtained by running water into a tank filled with the marc or pomace; the overflow is allowed to run into a second tank containing pomace, and the overflow from this tank passes into a third tank filled with pomace. It is seldom profitable to distil the wash unless it contains from 5 to 7 per cent alcohol.

Tartar.— This is extract from the lees, or deposited as a crust in the vats. It is obtained by causing a mixture of the marc and water to boil slowly for an hour or so; when the boiling liquid is drawn off and cooled the tartar crystallizes out. From the crude product is manufactured "cream of tartar" and tartaric acid.

Manufacture of White Wine.—The making of white wine differs from that of red wine principally in the matter of not having fermentation of the must take place in contact with the skin and solid parts of the grape. Two processes are to be taken into account: (1) the making of white wine from white grapes, and (2) the making of white wine from red or dark-colored grapes. The first-named process is of course the easiest one. Briefly stated, it consists in crushing the grapes, draining them, putting the drained marc in the press and then leaving the juice from both of the operations to ferment. The main thing is to get the liquid free from impurities, as white wine should be perfectly clear. The usual method is to allow the must to settle and the suspended impurities to be deposited. The liquid must, therefore, be kept perfectly still for the required time; in other words, it is kept from starting into fermentation. This is accomplished by the process called "sulphuring." The effect of applying sulphurous acid to the must is to paralyze the action of the ferments or yeasts.

After the must has become clear, it is separated from the deposit and run into the vat to undergo fermentation. During this process the must should be aerated as much as possible in order to drive off all odor of the sulphurous acid, as well as to encourage the activity of the yeast. The fermentation starts slowly and is always less vigorous than in case of red wines. When the fermentation is over, the white wine should be racked and put in casks which have been lightly sulphured and allowed to remain until perfectly cleared.

The manufacture of white wine from red or dark-colored grapes is attended with much more difficulty and labor than in the process of using white grapes. Without going into details, the main points to be observed are: (1) to avoid breaking the skins of the grapes and thus start fermentation before crushing; (2) to proceed rapidly with the work of crushing and pressing; (3) to crush the grapes so as not to free the coloring matter in the skins; (4) to suppress all traces of coloring matter in the must and separate the suspended impurities by the method above described. It is the opinion of expert wine-makers that in order to obtain the best results, white wine should be made from both white and red grapes.

Sweet Wines.— The familiar French term for sweet wines is *vins de liqueur*. These wines are the result of special treatment or handling. The best-known types of sweet wines are: Port, Sherry, Tokay, Madeira, Malaga, etc.

Port Wine.— Wines of this type are produced by fermenting the must down to 6 or 8 degrees of sugar and then from 8 to 10 per cent of brandy is added to arrest further fermentation. This will give a wine having from 14 to 18 degrees alcoholic strength. In the following spring the wine is racked and from 2 to 3 degrees more of brandy added. Thus, in the course of a year or so Port wine is gradually brought up, or "fortified," to 20 and 22 per cent alcoholic strength. Contributing to the final result is the "blending," whereby improved color, body, flavor, bouquet, etc., are obtained.

Sherry Wine.— Our word "Sherry" is derived from the Spanish name Xeres, and this type of wine was originally produced and shipped from the town of Xeres. It is made from several varieties of white grapes grown

in the province of Andalusia. The former Spanish custom was to sprinkle each pressing of grapes with a certain amount (two or three handfuls) of gypsum. This operation, called plastering, was regarded as favoring fermentation. The must is fermented down to about 8 or 10 degrees of sugar and then alcohol is added, bringing the wine up to 18 or 20 degrees of alcoholic strength.

One feature of the manufacture of sherry wine in Spain is the system of *Soleras*. The word describes fine old mother wine, and the system consists in blending wines of different ages or years. Thus, the casks of sherry wine are arranged in groups, piled in tiers and the groups graded according to quality. When wine for blending or shipment is drawn from the group of casks constituting the oldest solera, they are refilled with wine from the casks of the next younger solera, and these again from the next, and so on down to the last group.

In order to hasten the ageing or maturity of the wine, it is baked by natural or artificial heat. The casks containing the wine are ranged in a building with the roof and side exposed to the hot sun covered with glass. The temperature in this sherry-house during the day runs as high as 140° F. and is maintained at night by fires. The large producers of sherry in California and elsewhere attain the same end by baking the wine in a specially-built chamber or room, which is heated by steam or hot air.

Champagne and Sparkling Wines.— The word "Champagne" was originally very properly applied to wines, whether still or sparkling, made in the Champagne district of France. It now has a wider and more special meaning. By custom and popular usage champagne is the name given to a type of sparkling wine produced by a process of fermentation in the bottle. Thus, we have not only French champagne, but German champagne, Italian champagne, American champagne, etc. Sparkling wines are produced in most wine-making districts; some of the best known are, Sparkling Saumur, Sparkling Burgundy, Sparkling Beaujolais, in France; Sparkling Moselle in Germany; Sparkling Catawba, in the United States, etc. There are also "imitation champagnes." These are still wines which have been made sparkling by having carbonic acid gas forced into them somewhat after the same fashion as soda water is produced.

The manufacture and manipulation of champagne requires considerable skill and knowledge. Some of the steps in the process may be described:

After the wine has gone through its first fermentation, it is racked off into casks and a blend of the juices of different grapes is made. The cuvée, as it is called, is generally a blend of the new wine with some old wine. Then the wine is bottled and put in a warm place in order to start a second fermentation. At the proper time the bottles are stored in cool vaults, where the temperature is 50° F. or lower the year round and where fermentation proceeds very slowly. It is important to keep the vaults at an even temperature, in order to prevent serious loss from breakage which a sudden rise in temperature would cause. This has been met by the installation of cold storage plants in champagne cellars in this country and abroad.

At first the bottles are stacked in horizontal layers, and as the wine begins to mature the bottles are placed in A-shaped racks. The bottles are gradually worked neck downward, in order to bring the sediment, which forms during the slow fermentation, down upon the cork. This is done by the workmen giving each bottle a quick shake once or twice a day during a period of four to six weeks. In many of the champagne cellars a machine is used to accomplish the same result in less than half that time.

When the wine is taken to the finishing-room, the sediment down on the cork is "disgorged"— that is, the workman loosens the cork and the lively pressure of the gas in the bottle forces out the sediment, leaving the body of the wine perfectly clear. Champagne in this state is "brut"—almost absolutely "dry." To please the taste and palate of consumers, the wine is sweetened by adding a little liqueur or "dosage" as the French call it, composed of rock candy syrup dissolved in old wine or brandy. The final operations comprise putting in a fine cork in the bottle, wiring and capping it, pasting on the label and casing the bottles in boxes for shipment. It has been figured that a bottle of champagne from start to finish is handled about 200 times.

Handling and Taking Care of Wine.— It is always necessary to keep casks or barrels of wine in a well-ventilated cool place. When wine is drawn off and when there is loss from evaporation, the barrel should be filled up.

New wine soon begins to clear itself by the deposit of solid matters held in suspension. The thick deposit which forms at the bottom of the cask is called the lees. In order to prevent the lees from mixing with the liquid, wines are "racked" or drawn off several times a year. The sudden changes of temperature in the spring and autumn disturb wines, and so it is the practice to rack them at these periods. When racking it is not desirable to let the wine come in contact with the air. In order to obtain perfectly clear wines it is usually necessary to filter or clarify them.

The following method for clearing red wines, such as claret, etc., may be recommended: Take the whites of five fresh eggs for every 50 gallons of wine, beat them up into a foam. Then put this foam into a gallon of the wine to be fined and after beating it again pour the mixture into the barrel.

Then take a stick and stir the whole barrel of wine until the foam appears at the bung-hole, which should be in about 10 minutes. Leave the bung off over night. The next day fill up the barrel with same kind of wine and drive in the bung. The wine should be bright in from 10 to 15 days; if not, then fill up, and at the end of another week it should be.

For clearing white wines, such as Riesling, Hock, Sauterne, etc., take one wineglassful of dissolved isinglass for every 50 gallons of wine. Beat this into a foam with a gallon of the wine to be fined. Pour it back into the cask and follow the directions above given for red wines. Usually the white wines take a little longer time to clarify than do clarets.

Some Diseases of Wine. Wines are subject to many diseases. They often become "sick." Then they need "nursing" and doctoring.

13 issued by the California Board of State Viticultural Commissioners. In the season of 1918, 6,000 carloads of wine grapes, amounting to about 90,000 tons, were shipped out of the State. The sharp drop in sweet-wine production in 1915 and 1918 was due, as has been mentioned, to new and excessive taxation. At the present writing (1919) the wine industry of the United States is facing a most serious situation, namely, national prohibition. The prohibition of the manufacture and sale of wines strikes at the thousands of vineyard owners whose crops are taken and used by the wine-makers. Thus, of the 350,000 acres of vineyards in California just about one-half, or 170,000 acres, are devoted entirely to "wine grapes," that is, to special varieties of grapes which are not fit or wanted for eating or table purposes, but on account of their vinous qualities these grapes are peculiarly adapted for making wines. It is evident that the enforcement of prohibition will bring heavy loss to the growers and will greatly depreciate the value of their properties.*

Such legislation is all the more unfortunate in view of the fact that grape and wine growing have been fostered and encouraged for the past 50 years by our State and national governments. Large appropriations have been made from year to year; experts have been engaged to help the vineyardists; experimental grape stations have been established — there are now 14 such stations in California alone — the farmers and growers have put in their labor and capital in the confidence that viticulture, which is such an important branch of agriculture, would not be ruined or destroyed. Few there are who will claim that the grape and wine industries are responsible for the alleged evils which are sought to be remedied by prohibition. Hence it is to be hoped that a great wrong and injustice will not be done by drastic and confiscatory legislation to these two great industries, which give employment to some 60,000 persons and which represent an investment of $150,000,000 capital.

Two Distinct "Types" of American Wines. — The wines produced in the United States are divided into two classes: (1) wines made east of the Rocky Mountains; (2) wines of California and the Pacific Coast States.

This division is due to the fact that there are two entirely different stocks, or kinds, of grapes grown in the United States.

East of the Rocky Mountains, only American or native varieties of grapes are grown.

In California and on the Pacific Coast, practically only European or foreign varieties of grapes are grown.

Therefore, our Eastern wines are of a different "type" from California wines, which for the most part resemble and have the well-known characteristics of their European prototypes.

The leading grape and wine-growing States east of the Rocky Mountains are: North Carolina, Virginia, New Jersey, New York, Ohio, Michigan and Missouri.

Considerable progress in Eastern wine-making has been made in producing a fine quality of champagne by the French process of fermentation in the bottle. A number of brands of American champagne, in color, taste, sparkle and purity, compare very favorably with the best imported kinds. The headquarters of the champagne industry in the United States is in the Lake Keuka region of western New York, which produces about 75 per cent of the output. Considerable champagne is also produced in northern Ohio and a fair amount in California. The total production of American champagne is now estimated at more than 150,000 cases, or 1,800,000 quart bottles per year.

In conclusion, the manufacture of wine and champagne is an infant industry in the United State. But we have in the Eastern States and in California all the opportunities and all the conditions for success. We have here the right climates, the proper soils, the best varieties of grapes, sufficient capital and the most intelligent labor and supervision in the world. Therefore, with all these things and with the growing demand for American wines, the wine industry in this country, if it is not discouraged or forbidden by unfavorable legislation, should have a prosperous future.

Bibliography.— The best books on wines and on the technical details of wine-making are in French. The following standard French works may be noted: Coste-Floret, 'Procédés modernes de Vinification,' in 3 parts, (1) Vins rouges, (2) vins blancs, (3) le résidus (1895-1902); Jacquemin, 'Production rationelle et conservation des vins' (1909); Cazalis, 'Traité pratique de l'art de faire le vin' (1900); consult also a valuable little book by Chancrin, 'Le vin' (1910). For making wines in hot climates consult Roos, 'L'industrie vinicole meridionale' (1898). For making sweet wines, Sebastian, 'Les vins de luxe' (1897). For making champagne and sparkling wines, Robert's 'Manuel pratique vins mousseux' (1904); Salleron et Mathieu, 'Etudes sur le vin mousseux' (1895), and Manceau's 'Oenologie Champenoise' (1917).

There are but few really useful books in English of recent date on the practical side of wine-making. We note the following: Thudicum and Dupré, 'Origin, Nature and Varieties of Wine' (1872); Rixford, 'The Wine Press and the Cellar' (1883); Husmann, 'Grape Growing and Wine Making' (1897); Mathews, 'Manual of Alcoholic Fermentation' (1909); Jordan, 'Quality in Dry Wines' (San Francisco, Cal., 1911); Bioletti, F. T., 'The Manufacture of Dry Wines in Hot Countries' (in Bulletin No. 167, University of California, College of Agriculture 1905), and Bulletin No. 177 on 'New Methods of Making Dry Red Wines' (1906). Consult also bulletins issued by the United States Department of Agriculture, the California State Board of Viticulture and special articles in the trade journals.

LEE J. VANCE
Publisher, 'The Beverage News,' New York

WINEBRENNER, win'brĕn-er, John, American clergyman, founder of the denomination known as the "Church of God". b. Frederick County, Md., 24 March 1797; d. 12

* According to latest reports the California vineyardists, far from meeting heavy losses from so-called Prohibition, reaped greater profits than ever. They shipped fresh wine grapes all over the country and to Canada, and to still further evade this shipped the grapes in a dried form for wine-making. The demand was created by the fact that the people in 1919 made their own wines. Grape syrup was made in great quantities in 1919. It was hoped that it would supplant maple and molasses syrups, but quantities of it were used in wine-making.

Sept. 1860. He was ordained a minister of the German Reformed Church in 1820, and was called in the same year to the Salem church, Harrisburg, Pa. He retained that charge until 1827 when his outspoken attitude against slavery and the traffic in intoxicating drinks led to his being asked to withdraw, and in 1828 he ceased to be connected with the Reformed Church. In October 1830 he established the denomination called the "Church of God," whose members also became known as Winebrennerians. He edited for some time the *Gospel Publisher*, afterward the *Church Advocate*, and issued several works, including 'A Treatise on Regeneration'; 'Practical and Doctrinal Sermons'; the 'Church Hymn Book', etc. See CHURCHES OF GOD.

WINEBRENNERIANS. See CHURCHES OF GOD.

WINES, Enoch Cobb, American penologist: b. Hanover, N. J., 17 Feb. 1806; d. Cambridge, Mass., 10 Dec. 1879. He was graduated from Middlebury College, Vt., in 1827, taught school in Philadelphia and Burlington, N. J., and entering the Congregationalist ministry in 1849 held pastorates at Cornwall, Vt., and Easthampton, L. I. In 1853 he became professor of languages in Washington College, Pennsylvania, and he was appointed president of Saint Louis University in 1859. He became secretary of the New York State Prison Association in 1862, and afterward devoted his life to the promotion of reform in the administration of criminal law and treatment of criminals. He founded the National Prison Association in 1870 and was instrumental in securing the attendance of representatives from 26 governments at the International Penitentiary Congress in London 4 July 1872. Among his writings are included 'Two Years and a Half in the Navy' (1832); 'A Trip to China' (1832); 'Hints on Popular Education' (1838); 'Prisons and Reformatories in the United States and Canada' (1867); 'State of Prisons and Child-Saving Institutions' (1880).

WINES, Frederick Howard, American statistician, son of E. C. Wines (q.v.): b. Philadelphia, Pa., 9 April 1838; d. 1912. He was graduated at Washington College, Pa., in 1857, and studied at Princeton Theological Seminary; was a chaplain in the Union army 1862–64; pastor of the First Presbyterian Church, Springfield, Ill., 1865–69, was secretary of the Illinois State Board of Commissioners of Public Charities 1869–93, and again 1897–99. He devoted much time to the interests of the work carried on by the National Conference of Charities and Correction, being its president in 1883; the National Prison Association of which he was president in 1904; and the International Prison Congress. He was assistant director of the United States census in 1899–1902. His publications include 'Defective, Dependent and Delinquent Classes in the United States' (10th Census); 'Crime, Pauperism, and Benevolence in the United States' (11th Census); 'Punishment and Reformation' (1895; rev. ed., 1910); 'Liquor Problem in Its Legislative Aspects (1897; 2d ed., 1898); 'Punishment and Reformation' (posthumously, 1919).

WINFIELD, Kan., city and county-seat of Cowley County, on the Walnut River and on the Atchison, Topeka and Santa Fé (three lines), Missouri Pacific and Frisco railroads, also the Southwestern Interurban. It was settled in 1870 and incorporated in 1871. The chief industrial establishments are butter plant, poultry packing, flour mills, metal manufacturing, stock food plant and cold storage. Plenty of natural gas, at door, for domestic consumption. Winfield has two colleges of Liberal Arts, Southwestern (Methodist Episcopal) and Saint John's Lutheran, also College of Music. The public schools of Winfield are rated first by the State University and the Manual Arts building was erected in 1916 in addition to regular High School and Junior High School. Music and drama are taught and also community extension work emphasized. The Commercial Club is unique in its size and operation and has among its committees one on Child Welfare. Winfield also has the unique distinction of having won the Stubbs-Horner prize in 1915 for being the best second class city in Kansas in which to rear children. The electric lighting and water plant is municipally owned and the water supply for palatability and purity is not outranked in Kansas. The city fire apparatus is all motor driven. Pop. 8,500.

WING, an organ of flight. In birds, the wings consist of the bones of the fore limbs, specially modified to form a support and axis, while attached to this skeleton are the muscles moving the limb (see ORNITHOLOGY), externally clothed with strong flight-feathers or "wing quills." (See FLIGHT). In the bat (q.v.) the wing consists of an expansion of the skin, supported on four of the fingers, which are extremely long. This leather-like membrane, or "patagium," extends from the fore limbs to the hind limbs, and in many cases between the hind limbs and tail as well. In such mammalia as the flying-foxes, flying-squirrels, flying phalangers, and in the lizards known as flying-dragons (qq.v.), the wing is a mere expansion of skin, extending along the sides of the body, often connecting hind and fore limbs, and serving as a parachute to sustain the animals in their flying leaps from tree to tree, but in no sense serving as an organ of true flight. In insects (q.v.), the wing is formed of two delicate skin layers, supported on hollow tubes or *nervures*, placed in communication with the respiratory or breathing system. The wings of insects become thus related to respiration, and by their movements probably aid in the diffusion of air through the breathing tubes.

WINGATE, George Wood, American lawyer: b. New York, 1 July 1840. He was educated in the public schools, and served with the 22d New York Volunteers during the Civil War. He originated systematic rifle practice for the instruction of the National Guard, and through his efforts the Creedmoor rifle range on Long Island was established. He was president of the National Rifle Association for 25 years, and is the author of 'Wingate's Manual of Rifle Practice' (1872); 'The Great Cholera Riots' (1880); 'On Horseback Through the Yellowstone' (1886); 'History of the 22d Regiment' (1896), also of many articles on military subjects.

WINGED BULL, *in architecture*, a decoration of frequent occurrence in ancient Assyrian

Society, the Manitoba Neglected Children's Society, the Old Folks Home, etc.

Libraries.—The Winnipeg city library was erected by the Carnegie Foundation and is maintained by the city council. It cares for the collections of the Manitoba Historical Society. There are several branches throughout the city in which fiction and books of popular circulation are housed for the convenience of readers and borrowers. The Legislative Library is housed in the Provincial Parliament Buildings and is large and complete in its special field. The University and several college libraries are ample and elaborate. There is a valuable law library in the new Courthouse.

Banks and Banking.—The banking system is carried on by private companies but under strict supervision by both the provincial and Dominion governments. The Merchants' Bank of Canada began its business in 1872 in Winnipeg. Other banks now operating there are the Bank of Hamilton, the Bank of Nova Scotia, the Bank of Ottawa, the Bank of Toronto, La Banque de Hochelaga, Canadian Bank of Commerce, Crédit Foncier Franco-Canadien, Union Bank of Canada, Home Bank of Canada, Imperial Bank of Canada, Molson's Bank, Royal Bank of Canada and the Winnipeg Financial Corporation.

Industries.—Being the outlet of a vast agricultural area to the markets of the world, Winnipeg ranks as one of the great grain centres both of America and Europe. It is also a market centre for horses, cattle and swine from the vast prairie areas. There are large engine, machine and railroad car shops of the three great systems entering the city. There are in addition slaughter-houses, packing establishments, lumber mills, rolling mills, foundries, flour mills, boiler and carriage works and a great number of minor manufacturing establishments. The value of its manufactured products is about $75,000,000 annually. Ample power facilities are afforded by the Winnipeg River, 60 miles distant. The water-supply system, municipally owned, brings water through a great aqueduct about 100 miles long from Lake of the Woods, the latter being about 100 feet above the level of the city.

History.—On the site of the present city in the days of the fur trade there was built Fort Rouge, in 1738, followed by Fort Gibraltar, Fidler's Fort, Fort Douglas and Fort Garry, the last named a post of the Hudson's Bay Company. The fort was dismantled in 1881. The modern city may be said to date from 1871, when there was a settled population of 215. The present city was incorporated in 1874, when the population was between 3,000 and 4,000.

Government and Population.—The city's affairs are vested in a mayor, four controllers and a board of 12 aldermen. The Parks Board is appointed by the city council and administers a fixed percentage of the city revenue. Since 1900 the population has increased rapidly. In 1908 it was 67,262 and in 1916 was 163,000. With the suburbs it is at present about 200,000.

GEORGE BRYCE,
Author of 'Short History of the Canadian People.'

WINNIPEG, Lake, Canada, is in the province of Manitoba and the district of Keewatin, and lies at an altitude of 710 feet above sea-level, between lat. 50° 20′ and 53° 50′ N. and long. 96° 20′ and 99° 15′ W. It is over 250 miles long, from 25 to 70 miles wide and covers an area of over 8,500 square miles It contains a number of islands, the longest being Reindeer and Big Island embracing respectively 70 and 60 square miles. It receives the surplus waters of Lakes Winnipegoosis and Manitoba and discharges by Nelson River in a northeasterly direction into Hudson Bay. The principal rivers flowing into it are, from the south, Red River; from the west, Dauphin and Saskatchewan rivers; and from the east, Winnipeg, Bloodvein, Berens and Poplar rivers. Lake Winnipeg is comparatively shallow, nowhere reaching the depth of 100 feet, a consequence being that its frequent storms are often exceedingly dangerous; this feature is augmented by its exposed condition owing to the low character of its shores which, on the south, are also very marshy. Fish in abundance are found in its waters, the white fish being widely known and valued on account of their size and flavor.

WINNEPEG RIVER, Canada, rises near Savanne in lat. 48° 47′ N. and long. 89° 57′ W., and flows in a general westerly direction under the names of Savanne, Seine and Rainy rivers into the Lake of the Woods. After it leaves this lake it is known as Winnipeg River and follows an extremely tortuous and often turbulent course until it finally discharges into Lake Winnipeg. It is navigable for a distance of 208 miles.

WINNIPEGOOSIS, win'i-pē-goo'sis, **Lake,** a lake in northwestern Manitoba extending into Saskatchewan. It lies to the west of Lake Winnipeg (q.v.) and parallel with it; its length is 127 miles, the width 17 miles; its elevation above sea-level 828 feet. It is generally shallow, the greatest depth not being over 40 feet. It receives the Red Deer and Swan rivers, and a few other smaller streams, and discharges into Lake Manitoba to the southeast, through the Water Hen River.

WINNIPISEOGEE, win-ē-pē-sā'gē, a lake in the east central part of New Hampshire. Its average length is about 25 miles; width from one to 10 miles; area, 178 square miles; and 475 feet above sea-level. The outlet is Winnipiseogee River, which flows into the Merrimac River. It has an irregular coast line, and contains a number of islands. The waters abound with fish. There are many summer cottages on the islands and along the shores.

WINNOWING MACHINE, a machine for winnowing grain by means of agitated sieves and a blower. The grain is usually introduced at the top of the machine into a hopper whence it falls on a sieve or series of sieves moving rapidly to and fro. Meanwhile a strong current of air is sent through the machine and blows out the chaff at one end. The cleansed grain is then graded by a series of sieves of different mesh and each size led to its proper chute. The early type of winnowing machines was of wood, and was moved by hand. The present-day machine, in America at least, is merely an attachment to the big power-driven threshing machines. Before the introduction of these machines the process of winnowing was slow

and laborious. It consisted in throwing up the grain by means of sieves or shovels while an air current, blowing across, carried away the chaff. Consequently winnowing was impossible on a windless day. When the first machine was introduced into Britain, by a farmer in Scotland in 1737, it met strong opposition, as interfering with the divine prerogative which alone had power over the winds. But the advantages soon overcame the prejudice whose record Walter Scott has preserved in 'Old Mortality' — making Mause Headrigg speak anachronously to her mistress about "a new-fangled machine for *dighting* the corn frae the chaff, thus impiously thwarting the will o'Divine Providence, by raising wind for your leddyship's use by human art, instead of soliciting it by prayer, or patiently waiting for whatever dispensation of wind Providence was pleased to send upon the shielin-hill."

WINNSBORO, S. C., city and county-seat of Fairfield County, on the Southern Railroad, about 34 miles north of Columbia. It is in an agricultural region, and in the vicinity are large stone quarries. At one time the city manufactured all the cotton-gins used in the United States. The educational institutions are Mount Zion Institute, established in 1878, as a public high school, but chartered as a school in 1777, and graded elementary schools. Pop. 1,800.

WINONA, wī-nō'na, Minn., city and county-seat of Winona County, on the Mississippi River, and on the Chicago, Milwaukee and Saint Paul, the Chicago, Burlington and Quincy, the Green Bay and Western, the Chicago Great Western, and the Chicago and Northwestern railroads, about 105 miles southeast of Saint Paul. The surrounding scenery is most picturesque, the peculiar rocks in and near the city are of interest. Sugar Loaf and Trempealeau Mountains are remnants of once lofty elevations, but are now included with the high bluffs which border the city. The city has steamer connection with all the Mississippi River ports, and the bridges which span the river at this point connect the city with places in Wisconsin. It is in an agricultural and stock-raising region. The chief manufacturing establishments are flour and lumber mills, agricultural implement works, wagon and carriage factories, railroad shops, breweries and patent medicine works. In 1914 the reported combined capital of the manufacturing establishments amounted to $12,013,000, while the value of production was $14,304,000. Winona has excellent transportation facilities and ships annually large quantities of grain, hay, vegetables, lumber and livestock. The principal public buildings are the government buildings, the courthouse, municipal buildings, the Winona General Hospital, the Margaret Simpson Home, opera house, churches and schools. There are several churches, including a Roman Catholic cathedral. The educational institutions are a State normal school, established in 1868; Winona Seminary (Roman Catholic), for young women, a public high school, opened in 1867, public and parish schools, Toland's Business University, and several private schools. The city owns and operates the waterworks. Winona was settled in 1851 and in 1852 was laid out as a town. In 1857 it received a city charter. Its growth has been somewhat rapid; but it has had no fictitious booms nor serious drawback. Pop. 18,583.

WINONA, Miss., town and county-seat of Montgomery County, on the Southern and the Illinois Central railroads, about 85 miles north by east of Jackson. It is in an agricultural region in which cotton and grain are the chief products. It has flour and grist mills, cotton gins and agricultural implement works. The two banks have a combined capital of $150,000. The high school was established in 1887. Pop. 2,512.

WINOOSKI, Vt., village in the town of Colchester (q.v.), in Chittenden County, on the Central Vermont Railroad, two miles north of Burlington. It has an electric railway to Burlington. It is in a fertile agricultural region, and has considerable manufacturing interests. The chief industrial establishments are sash, door and blinds factories, wagon and carriage works, cotton and woolen mills, iron and brass works, machine shops, flour mill and furniture factory. It has a high school, Providence Academy (Roman Catholic), public and parish schools and the Fanny Allen Hospital. Pop. 4,520.

WINOOSKI, or ONION, a river in Vermont, which has its rise in the northeastern part of the State, flows in a southwesterly, then northwesterly direction, breaking through the Green Mountains, and enters Lake Champlain about five miles northwest of Burlington. Total length about 100 miles. In several places it has cut deep picturesque gorges, and it has several falls. The falls at Middlesex and Winooski furnish extensive water power for manufacturing. The valley of the Winooski is noted for its beautiful scenery.

WINSHIP, Albert Edward, American editor: b. West Bridgewater, Mass., 24 Feb. 1845. He studied at Andover Theological Seminary, and in 1876–83 was pastor of the Prospect Hill Church, Somerville. Since 1886 he has edited the *Journal of Education*, Boston. He was a member of the Massachusetts Board of Education in 1903–09. He has lectured extensively, and is author of 'Life of Horace Mann' (1896); 'Great American Educators' (1900); 'Our Boys' (1909), etc.

WINSHIP, George Parker, American author and librarian: b. Bridgewater, Mass., 1871. He was graduated from Harvard in 1893, and was assistant in history there in 1893–95. He was librarian in charge of the John Carter Brown Library, Providence, R. I., from 1895 to 1915, when he became librarian of the Harry Elkins Widener Collection, in the Widener Memorial Library, Harvard. He has written 'The Coronado Expedition' (1896); 'Geoffrey Chaucer' (1900); 'Cabot Bibliography' (1900), etc., and has edited Wafer's 'Darien' (1903); 'The Letters of Three Rhode Island Children' (1904); 'Boston in 1699' (1905); 'Three Proclamations Concerning the Lottery for Virginia, 1613–21' (1907); 'Fifteenth Century Books in Brown University Libraries' (1910); 'Major Bradford's Letter, 1676' (1914).

WINSLOW, winz'lō, **Edward,** American colonial governor: b. Droitwitch, Worcestershire, England, 19 Oct 1595; d. at sea, between Santo Domingo and Jamaica, 8 May 1655.

While making a tour of the Continent he became a member of John Robinson's Leyden congregation. He was one of the passengers in the *Mayflower*, and in the first conference with Massasoit offered himself as a hostage, and won the attachment of the Indian chief, which he increased in 1623 by curing him of a severe illness. After the death of his wife during the first winter at Plymouth he married Mrs. Susannah White, mother of Peregrine White, her husband having died in that same winter also, and theirs was the first marriage in New England. In 1623–24 he made two voyages to Europe as agent for the colony, of which he was chosen governor in 1633, 1636 and 1644. While visiting England again in 1635 as agent for the colony, he was imprisoned by Laud in the Fleet prison for 17 weeks on the charges of having taught in the church, although a layman, and of having performed marriage as a magistrate. Another voyage was made by him in 1646 to answer charges against the colonists of religious persecution and intolerance. In 1649 he again visited England, was instrumental in the organziation of the society for the propagation of the gospel in New England, and was employed in various public affairs under the Commonwealth. In 1655 Cromwell appointed him one of three commissioners to superintend an expedition against the Spaniards in the West Indies, and he died before its completion. He was the author of several works, mostly controversial writings in defense of New England. The principal are 'Good News from New England' (1624); 'Hypocrisie Unmasked' (1646); 'The Danger of Tolerating Levellers in a Civil State' (1649), and 'Glorious Progress of the Gospell amongst the Indians' (1649). These have been reprinted by the Massachusetts Historical Society.

WINSLOW, Forbes Benignus, English alienist: b. London, of a Massachusetts family, August 1810; d. Brighton, Sussex, 3 March 1874. He came to this country in early life, studied medicine in New York, was graduated from the College of Surgeons, London, in 1835, and took his M.D. at Aberdeen. Having after 1830 paid special attention to the study of insanity, he opened a private asylum at Hammersmith, and later another in London, and came in time to be a supreme authority on all relating to diseases of the brain. He founded and edited the *Quarterly Journal of Psychological Medicine and Mental Pathology* (1848) and the *Medical Critic* (1861), was the juridical and president of the Medical Society of London (1853), and a member of numerous scientific bodies. He published 'The Application of Phrenology to the Elucidation and Cure of Insanity' (1831); 'Anatomy of Suicide' (1840); 'Plea of Insanity in Criminal Cases' (1843); 'Notes on the Lunacy Act' (1845); 'Softening of the Brain' (1849); 'Lethsonian Lectures on Insanity' (1854); 'Obscure Diseases of the Brain and Disorders of the Mind' (1860; 4th ed. 1868); 'Light, its Influence on Life and Health' (1867).

WINSLOW, Hubbard, American Presbyterian clergyman: b. Williston, Vt., 30 Oct. 1799; d. there, 13 Aug 1864. He was graduated from Yale in 1825 and from Yale Theological Seminary in 1828. He was pastor of the First Church, Dover, N. H., 1828–32, and of the Bowdoin Street Church, Boston, 1832–44, and during the next 10 years was the principal of the Mount Vernon Young Ladies' Institute at Boston. He edited the *Religious Magazine* 1837–40, lectured widely on religious and secular topics, was pastor of the First Presbyterian Church, Geneva, 1857–59, and of the Fiftieth Street Presbyterian Church, New York, 1861–62. He was a voluminous writer, and among his works may be cited 'The Doctrine of the Trinity' (1831); 'Controversial Theology' (1832); 'The Appropriate Sphere of Woman' (1837), republished as 'Woman as She Should be' (1838); 'Elements of Intellectual Philosophy' (1852); 'The Hidden Life' (1863).

WINSLOW, John, American soldier: b. Plymouth, Mass., 27 May 1702; d. Hingham, Mass., 17 April 1774. In 1740 he was appointed by the council captain of a company recruited in Boston for the expedition against Cartagena (q.v.); and in June 1754 sailed in the provincial ship *Massachusetts* to build a fort on the Kennebec. This he began on a point half a mile below the Teconick Falls, where it was finished by William Lithgow in the next year. With Scott he was a commander of the 1,800 troops sent by New England in 1755 to remove the French from the posts established on the Bay of Fundy. The French forts at Beauséjour and Gaspereau were taken, and on 11 August Winslow, then with rank of lieutenant-colonel, and in command at Mines, was instructed to remove the Acadians in his vicinity, a task which he described to the French inhabitants as "very disagreeable." He strictly followed his orders, however, as "it is not my business to animadvert." In 1756 he was appointed to command the campaign on Lake Champlain, holding now the grade of major-general, and was stationed at Fort William Henry. He led another expedition to the Kennebec in 1758–59, and subsequently was chief justice of the Court of Common Pleas for Plymouth County and a member of the legislature and the council. He was associated with Samuel Adams in the preparation of documents regarding the Stamp Act troubles.

WINSLOW, John Ancrum, American naval officer: b. Wilmington, N. C., 19 Nov 1811; d. Boston, Mass., 29 Sept 1873. He was appointed midshipman in the navy in 1827, was promoted lieutenant in 1839, and served in the Mexican War, participating in the expeditions against Tabasco, Tampico and Tuspan. He was made commander in 1855, in 1861 joined the Mississippi flotilla, and in 1862 was commissioned captain. In 1863–64 he was in command of the steamer *Kearsarge*, assigned to the special duty of pursuing the Confederate privateer *Alabama*. On 14 June 1864 he found the *Alabama* off Cherbourg, France, and blockaded her in that harbor until 19 June, when Captain Semmes notified Winslow of his intention to fight. The *Kearsarge* steamed seven miles out from shore in order to be on neutral waters, and then turned to meet the privateer. The *Alabama* fired the first shot, and the battle continued for an hour and a half, the vessels fighting in circles, which brought

them constantly closer until the distance between them was but 600 yards. The *Alabama* then began to sink and raised the white flag. Winslow numbered but three killed and wounded out of his crew of 163 officers and men, and took 65 prisoners. It was the most important sea fight of the war between two ships, and Captain Winslow received a vote of thanks from Congress, and was promoted commodore, his commission dating from the hour of his victory. He was in command of the Gulf squadron in 1866–67, was promoted rear-admiral in 1870, and was commander-in-chief of the Pacific squadron in 1870–72. Consult Ellicott, 'The Life of John Ancrum Winslow' (New York 1902).

WINSLOW, Josiah, American colonial governor, son of Edward Winslow (q.v.): b. Marshfield, Mass., 1629; d. there, 18 Dec. 1680. From the command of the Marshfield military company in 1652 he rose to the rank of major and commander-in-chief of the forces of the Plymouth colony in 1658. He was chosen deputy to the general court in 1653, and was one of the commissioners of the united colonies from 1658 to 1672. He was assistant governor of the Plymouth colony for several years prior to 1673, and from that date till his death was its governor, the first native-born governor in New England. During King Philip's War he was ex officio, and, according to rank, general-in-chief of the entire army of the united colonies. He wrote a poem commemorative of Governor Bradford, which may be found in Morton's 'New England Memorial' (1669).

WINSLOW, Miron, American missionary: b. Williston, Vt., 11 Dec. 1789; d. Cape of Good Hope, Africa, 22 Oct. 1864. He was graduated from Middlebury College, Vermont, in 1815, and from Andover Theological Seminary in 1818. He went as a missionary of the American Board to Ceylon 1819, and continued in the mission field for 44 years. He founded the Madras mission 1836; was president of the native college at Madras 1840; translated the Bible into Tamil 1835, and published 'A Tamil and English Dictionary' (1862), a great work, containing over 67,000 Tamil words, the most complete of its time.

WINSLOW, William Copley, American Egyptologist, son of Hubbard Winslow (q.v.): b. Boston, Mass., 13 Jan. 1840. He was graduated from Hamilton College, Clinton, N. Y., in 1862, and from the General Theological Seminary, New York, in 1865. He took orders in the Episcopal Church, was rector of Saint Luke's Church, Lee, Mass., 1867–70, and in 1883 became secretary of the Free Church Association in the Episcopal Church. He was assistant editor of the New York *World* 1862–63, and of the *Christian Times* 1864–65. He founded the American branch of the Egypt Exploration Fund in 1883, and served until 1903 in some official capacity. He has written 'Israel in Egypt' (1883); 'The Store City of Pithom' (1885); 'A Greek City in Egypt' (1887); 'The Egyptian Collection in Boston' (1890); 'The Pilgrim Fathers in Holland' (1891); 'Governor Edward Winslow,' etc.

WINSLOW, Me., town in Kennebec County, at the confluence of the Kennebec and Sebasticook rivers, 18 miles north of Augusta, on the Maine Central Railroad. The Block House, built in 1754, is still in excellent condition. There is a high school. Manufactures include woodwork and paper. The town was incorporated in 1771. Pop. about 2,709.

WINSOR, win'zor, **Justin,** American historian and librarian: b. Boston, Mass., 2 Jan. 1831; d. Cambridge, 22 Oct. 1897. He was educated at Harvard, and subsequently studied at Paris and Heidelberg. He was superintendent of the Boston Public Library 1868–77, and librarian of Harvard 1877–97. He published 'History of the Town of Duxbury' (1849); 'Bibliography of Original Quartos and Folios of Shakespeare' (1876); 'Reader's Handbook of the American Revolution' (1880); 'Memorial History of Boston' (edited 1880–82); 'Narrative and Critical History of America' (edited 8 vols., 1884–89), his most scholarly achievement; 'Christopher Columbus' (1891); 'From Cartier to Frontenac' (1894); 'The Mississippi Basin: The Struggle in America between England and France' (1895). He ranked as the highest authority on the early history of North America.

WINSTED, Conn., city, one of the county-seats of Litchfield County, on the Mad and Still rivers, and on the Central New England and the New York, New Haven and Hartford railroads, about 26 miles northwest of Hartford. It is in an agricultural region, and is the commercial and industrial centre for quite an extent of country. The Mad River furnishes considerable water power, which is utilized for manufactories for cutlery, clocks, sheet brass, brass novelties, bolts, chain hoists, spool silk, edge tools, pins, hosiery and undertakers' supplies. The town of Winchester, in which is the city of Winsted, had, in 1914 (government census), 147 manufacturing establishments, capitalized at $4,233,578, and employing 3,168 wage-earners. The value of the annual products was $4,131,327. From 1914 to 1919 the manufacturing industries have increased; the number of employees is now about 4,000. The educational institutions are Gilbert (high) school, Saint Margaret of Cortona Academy, public and parish schools and the Memorial and Gilbert School libraries. Located in Winsted are the Litchfield County Hospital of Winchester, and the William L. Gilbert Home for Indigent Children. There are four banks, which in 1918 had deposits amounting to $4,537,534. Winsted receives considerable water power from Highland Lake, a body of water on the western side of the city; and the water supply comes from Crystal Lake. The place was settled in 1756. The town of Winchester war founded in 1771. Winsted was incorporated as a borough in 1858, and town and borough governments were consolidated in 1915. The town government is vested in a commission of five selectmen. Pop. about 9,000.

WINSTON, John Anthony, American politician: b. Madison County, Ala., 4 Sept. 1812; d. Mobile, Ala., 21 Dec. 1871. He was educated at Lagrange College, Alabama, and at the University of Nashville, Tennessee, and subsequently engaged as a cotton planter and commission merchant. He was elected to the State assembly in 1839–40 and in 1842; to the

State senate in 1843, serving until 1852, and was president of that body in 1845–48. At the Baltimore convention of 1848 he was the recognized leader of the Alabama Democracy, and in 1853–56 was governor of his State. He was the first native-born governor of Alabama, and by his refusal to sign certain bills for aiding railroad companies by State loans he gained the title of the "veto governor." His course was sanctioned, however, by the people, as he was re-elected in 1855, and his measures were sustained by the legislature in the following session. He was a delegate to the Charleston convention of 1860 and opposed secession, but later became a colonel in the Confederate army. He commanded a brigade in the Peninsular campaign, and was conspicuous for gallantry at Seven Pines, but his health compelled his retirement from the army soon afterward, and he took no further active part in the war. He was a member of the State constitutional convention in 1865, and in 1866 was elected to the United States Senate, but was refused admission.

WINSTON, N. C. See WINSTON-SALEM.

WINSTON-SALEM, N. C., twin city, county-seat of Forsyth County, on the Norfolk and Western and the Southern railroads, 115 miles north of Raleigh and 28 miles west of Greensboro. Winston and Salem have independent municipalities, but as they are one commercially and industrially, they are usually called Winston-Salem. The city is the commercial centre of a fertile agricultural region, especially noted for its tobacco. It is a manufacturing city of importance; the tobacco manufacture is the leading industry; there are large tobacco warehouses, and plug and leaf tobacco factories, representing about $2,000,000 capital invested; other industrial establishments include chemical works (the largest in the South), roller mills, cotton mills, knitting mills, a box factory, machine shops and foundries. The business is mostly concentrated in Winston, while Salem is mainly residential. The streets are broad and well paved, and there is a large park; the city has an electric railway and two systems of waterworks, one under the ownership of the municipal government of Winston. Of the public buildings the courthouse in the central square of Winston and the city hall and armory are the most notable; in 1904 plans were laid out and soon work was begun on the erection of a United States government building. There is an excellent public school system, including a graded school for colored children; and the city is also the seat of the Salem Academy and College; a Moravian school for young women, founded in 1802; the Salem Boys' School (Moravian), and the Slater Industrial and Normal School, a non-sectarian institution for the colored race. Salem was founded in 1766 by Moravians as a church community. For a number of years the town was governed by the church in affairs secular as well as religious. The Moravian bishop, Count Zinzendorf (q.v.), made the plans for the city and for the government which existed during the first years. The government of Salem is now administered under the revised charter of 1891; the government of Winston under the charter of 1899; in both cases the mayor is elected every two years. Pop. Winston 17,167; pop. Salem 5,533.

WINT, Peter De. See DE WINT, PETER.

WINTCHEVSKY, Morris (*nom de plume* of L. BENEDICT), Yiddish poet: b. Government of Kovno, Russia, 1856. He received a good education, and his verse first appeared in the periodical *Ha-Magid* in 1873. He was connected with Socialistic propaganda work in London in 1879–1906; and in 1906–14 he edited *Die Zukunft*, a Socialistic periodical published in Yiddish, in New York. He ranks among the leading Yiddish poets and is known also for his satirical and philosophical sketches. In English he is author of 'Stories of the Struggle' (1908).

WINTER, Sir James Spearman, Canadian statesman: b. Lamaline, Placentia Bay, Newfoundland, 1 Jan. 1845; d. Toronto, 6 Oct. 1911. He was called to the bar in 1867 and was notably successful in his profession. He served in the Newfoundland House of Assembly in 1874–89, was its Speaker in 1877–78, Solicitor-General in 1882–85, and Attorney-General in 1885–89. He was a judge of the Supreme Court of Newfoundland in 1893–96; and in 1897–1900 he was Premier. He represented Newfoundland at the Washington Fisheries Conference in 1887–88; and in 1890 and 1898 he was a delegate to the London conferences in regard to the French Treaties question. He was also a member of the Anglo-American International Conferences at Quebec and at Washington in 1898.

WINTER, John Strange. See STANNARD, HENRIETTA.

WINTER, William, American author and dramatic critic: b. Gloucester, Mass., 15 July 1836; d. 30 June 1917. He was graduated from the Harvard Law School in 1857 was admitted to the Suffolk County bar, but never practised, preferring to devote his time to literature. He published in 1854 a book of verse, 'The Convent, and Other Poems'; and was for a time a successful lyceum lecturer. From 1860 he was a contributor to the *Saturday Press* and other New York periodicals; for several years was assistant editor of the *Albion;* and in 1865 became dramatic reviewer for the New York *Tribune* for which he continued to write until 1909. He was at one time also managing editor of the New York *Weekly Review;* and he has been a frequent contributor to leading magazines and reviews. In addition to his criticism, he became known also for his biographical studies, and his sketches of travel abroad and historic foreign localities. His prose style is one of considerable distinction, and his verse is finished in character. He wrote further 'The Queen's Domain, and Other Poems' (1856); 'My Witness' (1858), poems; 'Thistledown' (1878), poems; 'Poems,' complete edition (1881); 'The Jeffersons' (1881); 'English Rambles' (1884); 'Henry Irving' (1885); 'Stage Life of Mary Anderson' (1886); 'Shakespeare's England' (1888–1910), chapters of travel and historical study; 'The Wanderers' (1889–92); 'Gray Days and Gold' (1889–1911), and 'Old Shrines and Ivy' (1892), essays on England; 'Shadows of the Stage' (1892–95); 'The Life and Art of Edwin Booth' (1893), and 'The Life and Art of Joseph Jefferson'

(1894); 'A Wreath of Laurel' (1898); 'The Theatre and the Public' (1905); 'Over the Border' (1911); 'Vagrant Memories' (1915). He also edited (1881) the works of Fitz-James O'Brien (q.v.), and 'The Shakespearean and Miscellaneous Plays of Edwin Booth' (1899).

WINTER, one of the four seasons, the coldest of the year. Astronomically considered, winter begins in northern latitudes when the sun enters the sign of Capricorn, or at the solstice about 21 December, and ends at the equinox in March; but in its ordinary sense it is taken to include the months of December, January and February.

WINTER-BERRY. Several members of the genus *Ilex*, of the holly family, are known by this name, including the inkberry (q.v.). They are all native to eastern North America, but the species commonly indicated by the name is the black alder (*I. verticillata*), and aborescent shrub, common in swampy places and along the banks of streams, often overhanging the water. The acute, oval leaves turn black in autumn, and the axillary cymes of tiny polygamodioecious, whitish flowers, are succeeded by brilliant scarlet berries, that are as large as a pea, and are so crowded on the bare branches as to appear verticillate. They remain on the shrub all winter, and twigs are often sold by city florists for winter decoration. The bark of the winter-berry is tonic and astringent, and in infusion has been employed as a lotion for dressing ulcers. The smooth winter-berry (*I. laevigata*) is a handsome shrub at all seasons and is similar to the black alder, but has larger stalked drupes, of a more orange tint, less crowded, and ripening earlier.

WINTER-CHERRY, a solanaceous herb (*Physalis alkekengi*) of the south of Europe, cultivated for its ornamental fruit. It is a downy perennial, with semi-decumbent stems and broad deltoid leaves. The axillary, solitary flowers have campanulate five-lobed whitish corollas. The calyces are also five-toothed and campanulate, but in fruit become inflated so that they are like miniature membranous balloons surrounding a pulpy, globose, cherry-like berry, which is edible, well flavored and acidulous, serving chiefly for preserves. These fruit-bladders are of a bright scarlet hue, and glow far into the winter. They will even keep their color for some time when cut. The plants are also known as alkekengi, bladder-herb, strawberry-tomato, etc. The Japanese winter-cherry (*Physalis francheti*) is very similar, but larger, having branches perhaps two feet high, with vigorous, soft, green foliage. They are profusely hung with bright orange-colored translucent lanterns, three inches in diameter.

WINTER CRESS. See CRESS.

WINTER FLOUNDER. See FLOUNDER.

WINTER WREN. See WREN.

WINTERGREEN, a name applied to several ericaceous plants which retain their foliage over winter. In eastern North America, the aromatic little *Gaultheria procumbens* (see GAULTHERIA) is generally the plant referred to by this name. It is a low shrub, barely six inches high, found in rocky woods, with creeping stems, half hidden, from which arise erect, reddish branches, bearing ovate glossy leathery leaves. These are serrate with bristly tipped teeth and are gathered in a tuft at the top of the slender stalk, the fleshy, white or pinkish, urn-shaped flowers nodding underneath. The fruits are bright scarlet, mealy, and spicy in flavor; and are really enlarged fleshy calyces which have enclosed the seed-capsules and assumed the form of a berry. They are sometimes called checker-berries, and remain throughout the winter. The whole plant is aromatic in taste, and is frequently eaten, foliage, berries and all. The spiciness is due to the volatile oil of Gaultheria (q.v.) which is a stimulant, astringent and diuretic drug, but is chiefly used for flavoring, confectionery or pharmaceutical preparations. It is a commercial product distilled from the wintergreen where it is plentiful, or from the sweet-birch (*Betula lenta*). The various members of the genus *Pyrola* are called wintergreen, such as the round-leaved wintergreen, a common plant with a few orbicular or [illegible], long-petioled, coriaceous leaves. The flowers are somewhat like those of the lily of the valley, and are fragrant. The spotted wintergreen (*Chimaphila maculata*) is another plant found in shady woods. It has a decumbent stem, sending up slender branches, which bear a few lanceolate leaves mottled with white, and several white flowers, tinged with purple. Still another wintergreen is the chickweed-wintergreen (*Trientalis americana*) a spring blooming herb, with a dainty white, starry blossom, poised above a whorl of foliage like tiny peach leaves.

WINTERHALTER, vĭn'tĕr-hăl-tĕr, **Franz, Xavier**, German painter: b. Menzenschwand, near Saint Blasien, 20 April 1806; d. Frankfort-on-the-Main, 8 July 1873. He was educated at the academies of Munich and Carlsruhe, and also studied a while in Italy. In 1834 he established himself in Paris, where he obtained the patronage of Louis Philippe, and of many persons of note. In like manner he was liberally patronized by the English court. His productions were principally portraits with a few fancy pieces and pictures of genre. In France he painted portraits of Louis Philippe and his queen, of all the members of the Orléans family, of Napoleon III and his empress, and of the prince imperial. He was the favorite court painter in England during the life of the prince consort and executed portraits of the Duke of Wellington, Sir Robert Peel, and other distinguished persons for the queen. His fancy pictures have little other merit than as elegantly composed figure pieces. He finished carefully, and imparted a pleasing and well-bred expression to his faces, with little or no character.

WINTER'S BARK, the cortex of an evergreen magnoliaceous shrub (*Drimys winteri*) of the mountains of South America. In commerce this bark is quilled or curved, gray outside, brown internally. It has a peculiar aromatic odor, a very pungent and astringent taste, and serves as a tonic, stimulant and anti-scorbutic drug. Paratudo bark is a variety of winter's bark. There are many substitutes for the drug, and much of the winter's bark of commerce is obtained from the West Indian *Cinnamodendron corticosum* and *Canella alba*.

WINTER'S TALE, The. 'The Winter's Tale,' by William Shakespeare, was probably

composed, and certainly performed, in 1611; is first known to have been published in the First Folio of 1623; and by all evidence belongs, with 'Cymbeline' and 'The Tempest,' to Shakespeare's latest work. In closely packed and elliptical language, and in verse which tends to break down into prose under the strain of its matter, each play of this group exhibits various and contrasting, even incongruous, materials, loosely linked together to produce from an unhappy and unpromising beginning a romantically happy close. From storm and shipwreck and exile, from slander upon women's virtue, from tyrannical usurpation, lust, and rage, from foul-mouthed charges and unmotived and almost pathological jealousies and conspiracies, from the death or exposure of children, such "dramatic romances" move on through idyllic love-scenes and lucky voyages to the happy marriage of lovers, the reconciliation of enemies and the restoration of children and of thrones. These closing works of Shakespeare were perhaps the outcome of a golden sunset mood — the mood which Dowden named "On the Heights"; but they are more likely to have been affected by externals — the vogue of Beaumont and Fletcher's dramatic romances in particular, and more generally by the prevalent Alexandrianism of contemporary taste, which preferred a staccato succession of fortuitous events, contrasted, surprising, picturesque and idyllic, to any closely knit dramatic structure or well-marked connection of action with motive, of scene with scene and of cause with effect.

Satisfying this taste there was present in Elizabethan literature a new ingredient, the Greek prose romances, which the Renaissance had made accessible in editions and translations — the 'Æthiopica' of Heliodorus, the 'Clitophon and Leucippe' of Achilles Tatius, and the 'Daphnis and Chloë' of Longus. Matter from one or more of them had been used by Sir Philip Sidney in his 'Arcadia' and by Robert Greene in several prose tales. From one of these — 'Pandosto; The Triumph of Time' (1588, 1607, 1609; often afterward reprinted as 'Dorastus and Fawnia'), Shakespeare in turn took nearly the whole plot of 'The Winter's Tale.'

'Pandosto' is certainly compounded of many simples; and nearly all come from one or another of the Greek romances. Heliodorus gives a hint for Greene's jealous king, and supplies outright his trial-scene, oracle, exposure of child with tokens, finding of child, and restoration of child to a father who, not knowing her, is about to condemn her to death; Achilles Tatius gives the imprisonment and brutal wooing of a maiden by a would-be lover; Longus gives rich details of the exposed child's rearing among the shepherds. 'Pandosto' is a réchauffé of Greek fiction, with all its diversity, loose motivation and fortuitousness.

Most of the foregoing material, taken by Greene from the Greek romances, is in 'The Winter's Tale.' The matters which Shakespeare has discarded are all among those which Greene added — the Queen's death, the King's wooing of his own daughter, the King's suicide. Shakespeare saves Hermione to be restored as a statue come to life; and his Leontes does not woo Perdita or kill himself. Such changes bring the play still nearer to the Greek romance type; other changes, again, substitute genuine motive and causation for the mere coincidences with which Greene was content; while still others make it probable that for pastoral material Shakespeare went behind Greene directly to a Greek romance, viz., Angel Day's English version (1587) of 'Daphnis and Chloë.' The Greek romances thus, both mediately and immediately, are important "sources" of 'The Winter's Tale.' In fact, this play stands as the typical representative of the Greek romance tradition in English drama.

The dramatic structure of 'The Winter's Tale' is what might be expected of such a tradition. Leontes' jealousy, for example, is not only without justification, but — unlike Othello's — without plausible motive or cause. Again, between Act III and Act IV the play breaks in two: in time there is a lapse of 16 years; in place a shift from Sicilia to Bohemia; in action a complete transference of interest to the affairs of the younger generation. And again at the end the scene shifts back to Sicilia; Perdita's "recognition" and her betrothal to Florizel occur off-stage and are only reported; while the chief interest is finally shifted back again to the restoration of Hermione. Sir Philip Sidney's 'Defence of Poesy' gave by anticipation an amusing censure of the type; and even the most liberal of modern dramaturgists — one who is not in the least under the spell of rules or "unities" — is severe upon these shifts. It is as if Shakespeare had set out to exemplify to the full not only "romantic" content but "romantic" structure.

Yet 'The Winter's Tale' is charming — charming just so far as it is not a type of anything, but is mere Shakespeare. For, as usual, Shakespeare has transmuted his tradition and has added fresh delights. His pastoral is an idyll of the world's springtime — its pure gold foiled just enough by Autolycus's roguery; nothing in all the great gallery of Shakespearean character surpasses in finish and reality Autolycus or the loyal Paulina; nothing in the tragedies is grander than the grand emotional play of the statue scene. What we remember of 'The Winter's Tale' is Perdita's daffodils and Autolycus' patter, Paulina's plain speaking, and above all, Hermione, every inch a queen, moving like some celestial luminary through all her noble phases, from ascendency, past crooked eclipses, back into the main of light.

'The Winter's Tale' was performed in 1611, in 1612–13, 1624 and 1634; but when revived in 1741, "it was announced as not having been played for nearly 100 years." Morgan's version of it, performed in 1754, was superseded in 1756 by Garrick's ('Florizel and Perdita'), which continued to be performed as late as 1796. Kemble revived the original at Drury Lane in 1802, playing Leontes to Mrs. Siddons's Hermione; and Charles Keene gave it in 1856 as a Greek play. Among celebrated Hermiones have been Helen Faucit (1847); Mary Anderson (1887), who played the double rôle of Hermione and Perdita; and Ellen Terry (1906).

For the less familiar views offered above consult Thorndike, Ashley H., 'The Influence of Beaumont and Fletcher on Shakespeare'

(New York 1901); Baker, George Pierce, 'The Development of Shakespeare as a Dramatist' (New York 1907); Wolff, Samuel Lee, 'The Greek Romances in Elizabethan Prose Fiction' (New York 1912); Matthews, Brander, 'Shakespere as a Playwright' (New York 1913).

SAMUEL LEE WOLFF.

WINTERSET, Iowa, city and county-seat of Madison County, on the Chicago, Rock Island and Pacific Railroad, about 45 miles southwest of Des Moines. It is in an agricultural region in which the chief products are wheat, corn and hay. In the vicinity are large stone quarries. It has flour mill, creameries, machine shop and coal and stock yards. It has an extensive trade in farm and dairy products. There are several churches, public and private schools and a public library, founded in 1891, Pop. 2,818.

WINTERTHUR, Switzerland, town in the canton of Zürich, on the Eulach, 17 miles northeast of Zürich. It has a fine town-house, a number of fine churches, a gymnasium, and a museum of natural history. Its situation among hills, many of which are clothed with vines, is specially pleasant. Cotton-spinning, cotton-printing, dyeing and the manufacture of machinery are actively carried on. Pop. about 25,333.

WINTHER, vĭn'tĕr, **Rasmus Villads Christian Ferdinand**, Danish poet: b. Fensmark, Zealand, Denmark, 29 July 1796; d. Paris, 30 Dec. 1876. He was educated at the University of Copenhagen, and became immediately popular on the appearance in 1828 of his first volume of poems. He was one of the truest interpreters of the Danish national character. Some of his numerous publications are 'Sang og Sagn' ('Song and Legend,' 1841); 'Lyriske Digte' ('Lyrical Poems,' 1849); 'Nye Digte' ('New Poems,' 1850); 'Hjortens Flugt' ('The Flight of the Hart,' 1856), a lyric romance of the Danish Middle Ages, his greatest work.

WINTHROP, Beekman, American government official: b. Orange, N. J., 18 Sept. 1874. He was graduated at Harvard University in 1897 and took the degree of LL.D. there in 1900. He was admitted to the bar in 1899. In 1900 he went to the Philippine Islands as private secretary to the governor, William H. Taft, whom he later served as assistant executive secretary and as acting executive secretary; and in 1903–04 he was a judge of the Court of First Instance. He was governor of Porto Rico in 1904–07; Assistant Secretary of the Treasury in 1907–09; and Assistant Secretary of the Navy in 1909–13. He has since been engaged in banking in New York.

WINTHROP, wĭn'thrōp, **Fitz-John**, American colonial governor, son of John Winthrop (1606–76) (q.v.): b. Ipswich, Mass., 14 March 1638; d. Boston, Mass., 27 Nov. 1707. He studied at Harvard and afterward in England, where he served in the army of the Protectorate until the Restoration. Returning to Connecticut in 1663 he was elected to the assembly in 1671, served as major in King Philip's War, and in 1686 as a member of the council of Governor Andros. He was a magistrate in 1689, major-general commanding the expedition against Quebec in 1690, Connecticut agent at London 1693–97, and governor of Connecticut from 1698 till his death.

WINTHROP, James, American jurist, son of John Winthrop (1714–79) (q.v.): b. Cambridge, Mass., 1752; d. there, 26 Sept. 1821. He was graduated from Harvard in 1769, was librarian there 1772–87, and for several years was chief justice of the Massachusetts Court of Common Pleas, and register of probate. He published 'An Attempt to Translate the Prophetic Part of the Apocalypse into Familiar Language' (1794); 'Systematic Arrangement of Prophecies relating to Antichrist' (1795), etc. His library was bequeathed to Allegheny College, Meadville, Pa.

WINTHROP, John, American colonial governor: b. Edwardston, near Groton, Suffolk, England (O. S.) 12 Jan. 1588; d. Boston, Mass. (O. S.) 26 March 1649. He studied at Trinity College, Cambridge, was trained to the law and, according to the testimony of Cotton Mather, was commissioned at 18 a justice of the peace. His earlier years were spent on his estate of Groton Manor, but his Puritan tendencies and the current of his political sympathies presently interested him in plans for colonization in America. When in 1629 a charter was obtained creating a corporation under the name of the "Governor and Company of the Massachusetts Bay in New England," the piety, learning and talents of Winthrop led to his election as governor. Converting his hereditary estate, yielding an annual income of £600 or £700, into money, he set sail in the *Arabella* from Yarmouth in the spring of 1630, with a company of about 900 persons. On the voyage he composed a small treatise, entitled 'A Model of Christian Charity.' On 12 June (O. S.) they arrived at Salem, Mass., and the government was immediately transferred to him by Endicott, who had been the acting governor for two years by authority of the London company, before the transfer of the charter to New England. He was re-elected every year until 1634, when his popularity had somewhat declined, partly on account of his long continuance in office. In 1636, when Sir Henry Vane was elected governor, Winthrop was chosen deputy governor, and during this and the follwing year occurred the celebrated controversy in regard to Mrs. Hutchinson and her doctrines. It this matter Vane and Winthrop were on opposite sides, and in the election of 1637 the latter was chosen governor over Vane. The inhabitants of Boston, however, were friendly to Vane and Mrs. Hutchinson, and Winthrop was at first slighted by his neighbors. Subsequently he engaged in a controversy with his defeated opponent in regard to the alien law passed by the general court. He was re-elected every year until 1640; and in 1642 the troubled state of the colony induced the settlers to call him again to the head of the government. He was again elected in 1643, in the two following years was made deputy governor, and in 1646 governor again, which office he continued to hold the remainder of his life. In his principles Winthrop was opposed to an unlimited democracy; and when the people of Connecticut were forming a government, he wrote them a letter in which he said that "the best part of a community is always the

least, and of that best part the wiser part is always the lesser.' But he was attached to civil liberty, disinterested, pure and conscientious. 'It would be erroneous,' says Palfrey, in speaking of the Commonwealth of Massachusetts, 'to pretend that the principles upon which it was established were an original conception of Winthrop's mind; but undoubtedly it was his policy, more than any other man's, that organized into shape, animated with practical vigor, and prepared for permanency, those primeval sentiments and institutions that have directed the course of thought and action in New England in later times.' Winthrop kept a journal containing an account of the transactions in the colony down to the year 1649. The first two books were first published in 1790, and the manuscript of the third, which was for a long [illegible]ost, was found in 1816 in the tower of t[illegible] South Church. The three were publishe[illegible] revised edition, entitled 'The History [illegible]w England from 1630 to 1649' (with notes by James Savage, 1825–26). Consult 'Collections of the Massachusetts Historical Society' (3d series, Vols. IX and X); Earle, A. M., 'Margaret Winthrop' (New York 1895); Twitchell, J. H., 'John Winthrop' (in 'Makers of America Series,' New York 1891); Whitmore, 'Notes on the Winthrop Family and its English Connections' (1864); Winthrop, R. C., 'Life and Letters of John Winthrop' (Boston 1864–67).

WINTHROP, John, American colonial governor, son of Gov. John Winthrop, of the Massachusetts Bay Colony: b. Groton Manor, Suffolk, England, 12 Feb. 1606; d. Boston, Mass., 5 April 1676. He was educated at Bury Saint Edmund's Grammar School, at Trinity College, Dublin, and at the Inner Temple, London, where he studied law. He obtained a commission in the army, and served with Buckingham in the expedition for the relief of the Huguenots near La Rochelle, France, in 1627, went in the following year to Turkey as an attaché of the British embassy, traveled in various countries of Europe, in 1631 joined his father in Massachusetts, where he became governor's assistant, and in 1633 settled at Ipswich, of which he was one of the principal founders. Obtaining a commission under a grant to the Earl of Warwick, he founded Saybrook, at mouth of the Connecticut River, in 1635, built there a fort, and was made titular governor. In 1645 he removed his family from Boston to Pequot Harbor, and in the following year founded New London. After the union of Saybrook with Connecticut he became a magistrate of the increased colony (1651), and from 1657 to the end of his life served almost continuously as its governor. He was bearer to Charles II (1662) of a loyal address from the Connecticut government, and received from the king a suitable charter for the colony. Under an equally favorable charter he secured the union of the Connecticut and New Haven colonies. He was one of the commissioners of the United Colonies of New England in 1675. A student of physics and chemistry, through his scientific attainments he became a member of the Royal Society, to whose 'Transactions' he was a contributor. Consult Waters, T. F., 'Sketch of the Life of John Winthrop, the Younger' (Cambridge, Mass., 1899).

WINTHROP, John, American physicist, great-grandson of John Winthrop (1588–1649) (q.v.): b. Boston, 19 Dec. 1714; d. Cambridge, Mass., 3 May 1779. He was graduated from Harvard in 1732, and from 1738 until his death was Hollis professor of mathematics and philosophy there. He was one of the most important American scientists of the 18th century and exercised much influence upon the scientific thought of his contemporaries, in particular upon Franklin and Count Rumford (q.v.). He noted the transits of Mercury in 1740 and 1761 going to Newfoundland in the latter year for this purpose in a vessel supplied by the Massachusetts Province. He twice declined the presidency of Harvard, was for some years a judge of probate for Middlesex County, and was a member of the governor's council 1773–74. He was a prominent advocate of political liberty. He published 'Lecture on Earthquakes' (1755), and is sometimes claimed as the founder of the science of seismology. He published 'Answer to Mr. Prince's Letters on Earthquakes' (1756); 'Account of Some Fiery Meteors' (1755); 'Two Letters on the Parallax and Distance of the Sun as deducible from the Transit of Venus' (1769).

WINTHROP, Robert Charles, American political leader: b. Boston, Mass., 12 May 1809; d. there, 16 Nov. 1894. He was graduated from Harvard in 1828, studied law with Daniel Webster, and was admitted to the bar in 1831. He soon became active in political life, allying himself with the Whig party, and in 1834 was elected to the Massachusetts legislature, where he served five years, being speaker of the house for three years. In 1840–50 he was a member of Congress, and in 1847–49 speaker of the House of Representatives. In 1850, on Webster's resignation from the Senate, Winthrop was appointed his successor for the unexpired term, but in 1851 failed to secure election to the Senate. In 1851, as Whig candidate for governor, he received a plurality of votes, but the constitution at that time required an absolute majority for election; the election, therefore, went to the legislature, where he was defeated. During his term in Congress he had shown himself a conservative, and, though opposed to the extension of slavery, and to the Mexican War, he had no sympathy with the extreme abolitionists, and desired compromise between North and South. His defeat was due, therefore, to a coalition between the Free-Soilers and the Democrats in the Massachusetts legislature. After the Whig party dissolved, he took no prominent part in political work; he did not join the Republican party, but occasionally spoke in behalf of the Democrats, though not actively affiliated with them. He made frequent public addresses on various national anniversaries and occasions, being the chief speaker at the laying of the cornerstone of the Washington Monument in 1848, and on the completion of the work in 1885. He was president of the Massachusetts Historical Association for 30 years, and had a leading part in the organization and direction of the Peabody Education Fund (q.v.). He wrote 'Life and Letters of John Winthrop' (1864–67); 'Washington, Bowdoin and Franklin' (1876); 'Memoir of Henry Clay' (1880).

Consult Winthrop, R. C., Jr., 'Memoir of R. C. Winthrop' (Boston 1897).

WINTHROP, Theodore, American soldier and novelist: b. New Haven, Conn., 22 Sept. 1828; d. Big Bethel, Va., 10 June 1861. He was graduated at Yale in 1848; traveled extensively in Central and South America; studied law at Saint Louis; was admitted to the New York bar in 1855, and joined the Seventh New York regiment in 1861. The *Atlantic Monthly* from June to September of that year contained sketches which he had written of early war scenes. He was killed at the head of an assaulting column of Northern troops at Big Bethel. He left completed material for five volumes of novels and essays; 'Cecil Dreeme' (1861); 'John Brent' (1862); 'Edwin Brothertoft' (1862); 'The Canoe and Saddle' (1862); and 'Life in the Open Air and Other Papers' (1863). These passed through many editions, and were reprinted in the 'Leisure-Hour Series,' with the addition of his 'Life and Poems,' edited by his sister, Laura Winthrop Johnson (New York 1884). Consult also a memoir by George William Curtis, prefixed to the earlier editions of 'Cecil Dreeme.'

WINTHROP, Me., town in Kennebec County, on the Maine Central Railroad, 20 miles northeast of Lewiston and 10 miles west of Augusta. It has oil-cloth factories, woolen mills, agricultural implement works, a corn cannery and a grist mill. There are six churches, a high school and graded elementary schools. It has a State bank. The oil-cloth industry was begun in Maine, in 1845, by C. M. Bailey of Winthrop. Pop. about 2,114.

WINTHROP, Mass., town in Suffolk County, on Massachusetts Bay and on the Boston, Revere Beach and Lynn Railroad, about five miles northeast of Boston. It is a popular beach resort and a favorite residential section for Boston. The town was originally a part of Boston, then of Chelsea and later of North Chelsea. In 1852 it was set off and incorporated. It contains many features of historic interest, chief of which is the Dean Winthrop house built in 1649. It has also Forts Heath and Banks, the Winthrop Shore Reservation, the Ingalls Park, and the Frost Public Library. Pop. 12,758.

WINTHROP NORMAL AND INDUSTRIAL COLLEGE OF SOUTH CAROLINA, an educational institution for white women, founded at Rockhill, S. C. in 1886. It gives normal and industrial training and is supported by State appropriations, but about one-half of its property, which is valued at nearly $1,000,000, has come from other sources than State funds. It admits girls of 15 years or over. Tuition fees are low and in case of inability to pay are dispensed with, and living expenses are reduced to a very low figure. Its combined departments enroll about 1,300 students, and its staff numbers about 100. It conducts a summer school. There are 18,000 volumes in the library. The plant and grounds are valued at $900,000.

WINTON, Pa., borough in Lackawanna County, on the Lackawanna River, eight miles northeast of Scranton, on the Delaware, Lackawanna and Western and the New York, Ontario and Western railroads. It is chiefly occupied in coal mining. Pop. about 5,280.

WINTUN ("people," "Indians"), a group of tribes, which, with the Patwin group, form the Copehan linguistic stock of North American Indians. The habitat of the stock is northern California from Mount Shasta, including the headwaters of the Sacramento and the valley of McCloud River; thence southeastward along the Sacramento Valley to the mouth of Chico Creek, from which point to its mouth the Sacramento forms the southeastern boundary. On the west the Coast range intersects the territory of the Copehan stock, the westernmost limit of which extends almost to the south branch of Trinity River, about lat. 40° 30′ N. From the latitude of Cape Mendocino the Coast range forms the western [illegible]dary as far as John's Peak, whence it e[illegible]n an irregular line southeastwardly to [illegible]lo Bay. The tribesmen live largely by [illegible], although various roots, nuts, berries, farinaceous seeds and clover blossoms form part of their subsistence. They are fond of water and are constant bathers in the streams that drain their country. Salmon are caught with spears, in the use of which they were exceedingly expert. Their weapons were formerly bows and arrows, and slings. They were indifferent hunters, but were successful in ensnaring deer in traps of their own construction. The population of the score or more of tribes forming the stock is not known, only the Nomlaki and the Wailaki being officially recognized. These are under the Round Valley Agency and are small in number.

WIRE, Manufacture of. At the present time all wire is made by the drawing process, and while permitting the production of a much thinner wire than could be obtained from the rolls, it also gives a wire of greater tensile strength, so much so that the smaller the size to which the wire is drawn down, the greater is its ultimate breaking strength per square inch. The breaking strength of English piano wire ranges from 225 pounds for No. 12 music wire, which is 0.029 inch in diameter, to 650 pounds for No. 22, which is 0.052 inch in diameter, indicating an ultimate tensile strength, ranging from 300,000 to 240,000 pounds per square inch. This wire shows a content of carbon, 0.570 per cent; silicon, 0.090 per cent; sulphur, 0.011 per cent; phosphorus, 0.018 per cent; and manganese, 0.425 per cent.

In the past all classes of iron wire were made entirely from wrought iron and required very careful preparation of the raw material to insure toughness and high tensile strength; but, with the discovery of the Bessemer and the open hearth converting processes, and the consequent lowering of the cost of production accompanied by an enormous increase in the strength of the raw material, wrought iron was quickly supplanted by mild steel. The great increase in the strength of steel wire over that of wrought iron may be better appreciated from the following statement of facts: The ultimate tensile strength of the best bright, hard-drawn wrought-iron wire is about 70,000 pounds to the square inch, while that of ordinary Bessemer steel is 80,000 pounds, and that of open-hearth steel is 120,000 pounds to the

simple a process as described above. In the making of tungsten wire for electric lamps it is necessary to develop a fibrous condition in the naturally brittle metal. This is accomplished by rolling and hammering rods of the metal while it is red-hot. The operation of drawing also must be done with the hot metal. As tungsten is very hard the dies (of high-speed tool-steel) are quickly worn away. The heat and pressure at which the metal has to be drawn renders the ordinary oily or fatty lubricants of no avail and the only lubricant found effective is fine graphite. This is smeared in paste form over the rod as it passes to the die, and just before it reaches that point a flame heats the rod and its graphite ointment to a red heat, burning in the graphite to a glossy black coating which so adheres that the lubrication lasts for passes through several successive dies. For the finest sizes of tungsten wire the dies are diamonds.

Barbed wire is manufactured in various patterns. The general process may be outlined by a brief description of the machine employed in making what is known as 2-point Glidden barbed wire. Four coils of wire on reels are placed behind the machine. The wire from two of the reels serves to form the strands, while that from the other two is used to form the barbs. The two strand wires, which are larger than the other two, are led between a pair of friction wheels and pulled to a proper tension and then crossed by the other two transversely, one on each side. At fixed intervals of a few inches, according to the desired spacing of the barbs, the two barb wires are caught by a pair of revolving fingers and twisted around one of the strand wires, and at the conclusion of the twist, two pairs of shears cut the ends of the barbs diagonally into sharp points. The wires then pass into a combined winding and twisting machine, by which the two strand wires are twisted around each other, and then to the spool where it is wound up ready for the market. When once started, the operation of wire making is continuous and rapid. The barbed wire used in trench warfare has from two to four times as many barbs as that for fencing cattle and requires additional reels and cutters in its production.

Wire in its several sizes is designated by number according to a scale or "gauge," depending on its diameter. Several different gauges are in vogue in the United States and cause considerable confusion to the uninitiated. The Bureau of Standards at Washington recommends for ordinary steel wire the American Steel and Wire Company's gauge. For piano wire the bureau recommends the same company's "Music Wire Gauge." For copper wire and wire of all metals and alloys other than iron and steel the gauge in commercial use is the Brown and Sharpe wire gauge — also called the "American Wire Gauge." The Birmingham wire gauge (B.W.G.) has been officially adopted by Congress, and is in use by the United States Treasury Department in laying duties on importations. It is almost obsolete in economic practice. Consult Smith, 'Wire: Its Manufacture and Uses' (New York 1891); Allen, H., 'Metallurgical Manual of Iron and Steel' (London 1911); Charnock, G. F., 'Mechanical Technology' (London 1915); Kiudl, F. H., 'Rolling Milling Industry' (Cleveland, Ohio, 1913).

WIRE AND WIRE DRAWING. Wire is defined as metal elongated into a long thread-like form of thicknesses varying from one and one-quarter inches to less than 1/1000 of an inch, each size uniform throughout the piece; these threads having usually the cylindrical form, but they may be square, flat, oval or ribbed, in which case they are known as "shaped wire." The process by which wire is formed is known as drawing. Essentially, this consists in forcibly pulling a suitably prepared piece of the metal thus worked through a series of holes made in hardened steel dies set in a draw-plate, and which successively diminish in diameter. In this way the cross section of the wire is gradually reduced to that of the last hole through which it is drawn; its length, meanwhile, being correspondingly and greatly increased. As a consequence, wire can be produced only from such metals as are susceptible in this way of being pulled out or extended by stretching into rods. Such metals are said to be drawable, or to have the property of ductility. This property is not to be confounded with that of malleability, namely, that in virtue of which a metal is laminable, or admits of being hammered or rolled into thin plates; since the same metal is often malleable and ductile in very different degrees. Thus, while gold possesses both these properties in an extreme, and probably in the highest known degree, iron is ductile in a degree far beyond that in which it is malleable, and with tin and lead the reverse is true. Of the familiarly known metals, the most ductile, and in the order named, are gold, silver, platinum, steel, iron, nickel, copper, brass, zinc, tin and lead; while some of the ordinarily brittle metals when made perfectly pure, as bismuth, are said to possess very high ductility. In early times metals were brought to the filamentous form only by means of beating them under the hammer into thin plates, then dividing these by cutting instruments into narrow strips, and finally rounding with the hammer and file. The earliest known mention of "wire drawers" and "wire millers," as those who produced wire by drawing were variously called, occurs in 1351 and 1360, in the histories respectively of Augsburg and Nüremberg, the previous accounts being only of "wire smiths," or those who fabricated wire with the hammer. The change from the old to the new method was accomplished, or very soon followed, by the introduction of a machine by which wire was successfully produced without direct aid of the hand; this machine, probably the invention of one Rudolf, of Nuremberg, was impelled by water power. The precious metals appear to have been the first subjected to this process — brass and iron not until some time later. White wire, or blanch iron wire, is mentioned in a list of articles not to be imported into England in 1463; and in 1484 both iron and latten (fine brass) wire are similarly named. Up to 1565 English iron wire was drawn by hand only, and was of so poor a quality that most of that used in the country, and also wool cards and other articles involving the employment of wire, were imported. As late as 1600 there was no wire mill in England; but in that year patents were granted to manufacture wire in England. In the history of United States industries the first mention of wire drawing occurs in the annals of the town

of Lynn, Mass., where it is recorded that in 1666 Nathaniel Robinson, a "wyer-drawer" petitioned the court for aid in carrying on his trade. This was refused at the time, but later the court authorized the purchase of instruments and tools for this industry and granted a bonus for its encouragement. In 1775 a wire factory was established by Nathaniel Niles in Norwich, Conn., and in 1788 a large wire mill was running in Dedham, Mass., making wire for cards and fishhooks. Pittsburgh had a wire factory in 1791. In 1834, however, there were only three wire mills in all the United States, and their total output was 15 tons for that year. It is worthy of note that one of these original three mills — that at Worcester, Mass. — is now the largest wire producing plant in the world.

The 1914 census of manufactures reported that in that year there were 99 establishments drawing wire in the United States; 54 being strictly manufacturers of wire and 45 being rolling-mills which drew wire in addition to their other business. Of the entire number 68 drew iron and steel wire: 28, copper wire; 28, brass wire; and 16, wire of other metals. Their equipment totaled 51,181 blocks and their total capacity was 3,852,000 tons of wire per annum. The 1914 output of these mills amounted to 2,435,530 tons of steel and iron wire; 138,924 tons of copper wire; 19,491 tons of brass wire; 106 tons of bronze wire; 375 tons of German silver wire; and 2,981 tons of wire of other metals. The aggregate value of the year's production was $172,600,546.

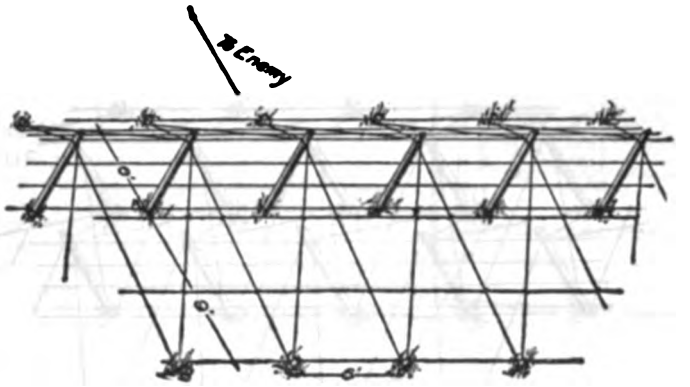
The modern system of wire drawing is described under WIRE, MANUFACTURE OF.

WIRE CLOTH, a sieve-like fabric whose woof and weft are of wire, the size of the wire, the shape and sizes of the meshes, being adapted to the uses of the completed screen, sifter, or sieve, or the character of the machine in which it is to be used.

WIRE ENTANGLEMENTS. By general consent the barbed wire entanglement has become the standard military obstacle. It was highly developed on the Western front during the European War 1914–18, the principal developments being along the line of simplifying the construction and in the use of artillery fire to open a passage for the artillery troops. In constructing "low wire entanglements," the party should consist of 32 workers, if possible exclusive of non-commissioned officers. Form the party in two ranks and number them in threes, both front and rear ranks. The left file is not numbered. For the sake of explanation letters are given to these parties of three as follows:

ooo	ooo	ooo	ooo	ooo
B	D	F	H	K
ooo	ooo	ooo	ooo	ooo
A	C	E	G	I

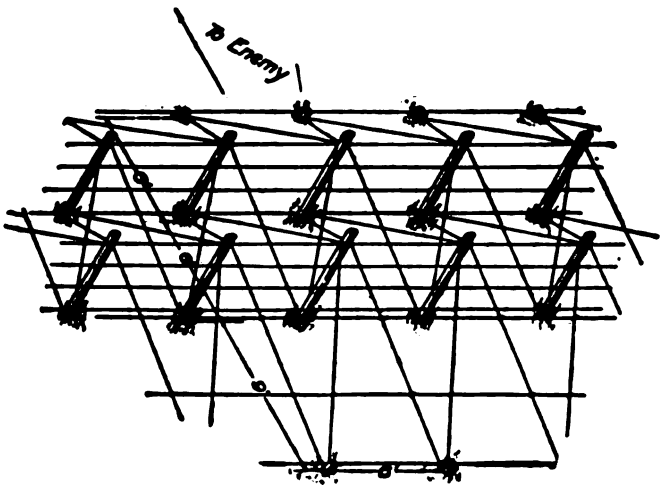
Duties of Parties.— Parties A and B go out almost simultaneously. Party A drives the first row of pickets and so needs a maul. The maul man should be tall. One man mauls, one supplies the pickets, one paces the three yards and holds the pickets for driving. Keeping close up so as not to lose the pickets, comes party B with a coil of barbed wire, a pair of wirecutters and two pairs of hedging gloves. All wire parties carry similar equipment. Starting at the anchor picket, party B runs out to the first straight wire, one man holding and uncoiling the wire, the other two taking round turns, each taking the turns on alternate pickets. About six yards behind is party C, a picket party which drives the second row of pickets, one man again mauling, one holding and pacing, one supplying pickets. This party measures the position of each picket from the front row by going to each picket in the front row, pacing one and one-half yards along the line, turning at right angles and pacing three yards and then planting the picket; this eliminates cumulative errors. Starting six yards behind C comes party D, which works on the same system as B and puts on the diagonal, keeping behind its own wire. Party E runs out the first loose wire, starting about 12 yards behind D. One man holds the coil and unwinds it. One man places the wire in position on the diagonal. The third man clips the loose wire to the diagonal. Party F comes 13 yards behind E and runs out the second straight wire, Party G drives the third row of pickets, measuring the position of each from those of the second row. Party H starts six yards behind G and puts on the second diagonal. Party I starts 12 yards behind H and runs the second loose wire. Party K starts 13 yards behind I and completes the bay with the third straight wire. The direction is kept by the men of the



Double Apron Entanglements.

left file, who provide themselves with a piece of string or tape, equal in length to the distance from the parapet to the front edge of the wire. They go out with party A. One man places himself at the foot of the parapet with one end of the string in his hand. The other runs the string out until it is taut. The man on the parapet keeps the string always perpendicular to the general line of the parapet. The other man keeps it taut and moves along with party A. Work can be done with parties of two men, but if one is hit the work is disorganized. If there are fewer parties the same party may have to do two or more parts of the work. Thus, if there are only six parties A will also do G's work. B will do H's, C will do I's, D will do K's. The pickets must be driven far enough in the first instance. If they have to be driven after the wire is on, the wire will be too low. Mauls should be muffled with sandbags nailed on.

strand of barbed wire is run along the top of each row of French wire, being fastened to the pickets with a round turn six inches above the French wire. These strands of barbed wire are pulled as taut as possible and are twisted on the French wire with a staple, peg or pair of wire cutters close to each picket and in several places between the pickets. This barbed wire supports the French wire. The two rows of French wire are about two feet apart and tied together by a diagonal strand of barbed wire running from the tops of the pickets of one row to the tops of the pickets of the other row. In addition a strand of barbed wire is run along the front of the front row of French wire and twisted to it. This is partly to hold up people trying to crawl through and partly to hold the French wire together, should it come loose from the fastenings. This wire is usually called the "apron wire." After this, more apron wire can be added or loose wires



Double Fence Entanglements.

French Wire.— This consists of a continual spiral of plain wire three feet six inches in diameter, each turn of wire being clipped to the turns on both sides in five places. When closed up it looks very much like a coil of plain wire, but when pulled out it makes a cylinder of wire mesh. Each small coil pulls out to the length of 20 yards. A big coil consists of five small coils. The extended coil can be easily crushed down by throwing a weight on the top and must, therefore, be supported by pickets and barbed wire. It is easily carried and quickly put up. It is held in place by iron staples five inches long. The number of men required for a party is 26. Two men keep the direction with a string as for low wire and the remaining 24 are divided into parties of three as for low wire. Two or more rows of French wire make an obstacle. Each small coil is stapled down in five places; that is, at each end, one-fourth, one-half and three-fourths of the way along. Where two coils meet the same staple fastens down both coils. Pickets five feet long are driven into the centre of the coils in five places as for the staple. These pickets should be driven in at least a foot. A may be inserted between the two rows. Where opposing trench lines are very close together, stakes cannot be driven for the usual form of wire entanglement on account of the noise of driving, which would draw fire. If not too close to the enemy, iron rods with a screw end may be used in lieu of stakes; these may be three-fourths inch in diameter with one or two loops in their length to which to fasten the wire. In ordinary ground such rods can be screwed into a firm hold without noise. When the enemy is too close for this, various forms of portable obstacles in the nature of *chevaux de frise* are employed. These are made up at the depots, brought forward through the trenches and tossed out in front by day or by night.

The "high wire entanglement" is similar in a general way to the low entanglement, but is four to six feet in height. It usually consists of three to five rows of stakes connected by barbed wire. In addition to the horizontal wires conecting the tops of the stakes, it has diagonal wires running from the top of each stake to the bottom of all adjacent stakes. The side toward the enemy should be completed as

an ordinary wire fence. Slight irregularities in height of stakes and arrangement of wires add to the value of the obstacle. Openings for the passage of troops through wire entanglements are generally about 10 yards wide and are placed so that two belts of wire overlap the openings. The continuity of the obstacle may be observed by using gates or barriers that can be quickly opened and closed.

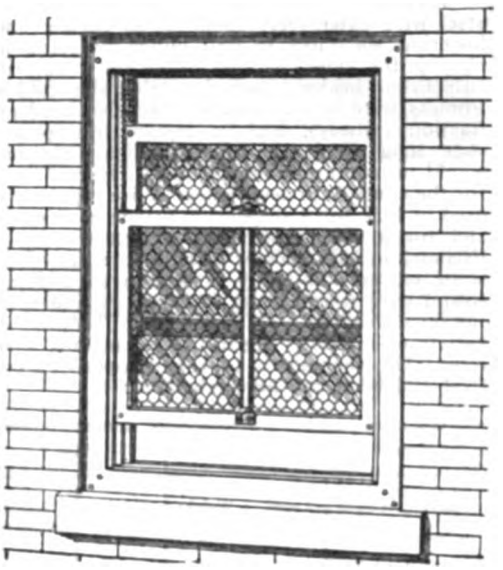
The best place for the openings is at the flanks of the supporting points, points between the wire entanglements around the supporting points and those in the intervals. If these openings must be placed in the intervals on account of the terrain, they must be covered by the close fire of sections of trench placed immediately in rear. The maintenance of a wire obstacle requires constant care. It should be inspected every night, and a few men should be detailed in each company as a permanent wiring party for the repair and improvement of the obstacle. In addition to barbed wire, a charged electric wire is at some places maintained. The wire is charged in section so that in a case of a ground only the section affected will be out of service instead of the entire wire.

EDWARD S. FARROW,
Consulting Military and Civil Engineer.

WIRE GAUGE, an instrument or mechanism for measuring the thickness of wire and sheet metals. It is usually a plate of steel having a series of apertures around its edge, each corresponding in width to the diameter of wire of a certain number. Commercially the standard sizes of wire conform to certain recognized gauges of which the Birmingham wire gauge is used in Great Britain and the American wire gauge in the United States. In 1893 a law was passed authorizing a standard gauge for the United States, for plate iron and steel. This gauge is somewhat used for wire and varies from No. 000,000 = .46 inch to No. 38 = .00625 inch. A special gauge has been developed for measuring electrical wires in units which are called circular mils. Consult 'Mechanical Engineer's Pocket Book' (latest issue) and 'Circular No. 31' of the United States Bureau of Standards.'

WIRE GLASS, a modern invention used in building construction, being a combination of wire and glass. Wire glass is either ribbed, rough rolled, polished plate or "maze," having wire netting imbedded in its centre during the process of manufacture. The temperature at which the wire is imbedded in the molten glass insures cohesion between the metallic netting and the glass, and the two materials become as one, so that if the glass is broken by shock, by intense heat or from other cause it remains practically intact. It combines the strength of the wire netting and the glass plate, and the wire is so thoroughly covered as to obviate the possibility of rust or corrosion. Wire glass will break, but it will not scatter. It can be fractured, but it will retain its place, and the perils incident to falling glass and the ingress or egress of draft and flame are avoided.

The first attempts to introduce a metallic mesh into the body of the glass were for the purpose of increasing its strength and to prevent its falling apart when broken. In this respect the product has been thoroughly developed, but in addition it has proved to be one of the most remarkable fire retardants available for building purposes, and in view of the exceptional hazard attaching to window and skylight openings in all buildings, its use as a fire retardant is outranking in importance as well as quantity its other values. Many experiments have been made to develop different processes of manufacturing wire glass, but, owing to the



Wire Glass Fire Proof Window

inherent difficulties of maintaining the homogeneous quality of the glass, preventing damage from excessive heat to the wire and securing a practical central location of the wire in the body of the glass only two methods have proved effective. One of these, known as the Shuman process, from the name of its inventor, Frank Shuman, of Philadelphia, consists of rolling a sheet of glass, laying the wire mesh upon the body of the glass, pressing the same into it instantly and while still plastic, and by a coincident process, smoothing over the slight abrasions made in the surface of the glass so as to secure a true and smooth surface on both sides. The other process known as the Appert process, from its inventor, Leon Appert, of France, involves the rolling of one sheet of glass, laying the wire mesh upon this sheet and immediately and by a simultaneous and continuous process pouring and rolling a second sheet upon the top of the wire so as to completely imbed it and secure at the same time an absolutely solid single sheet of finished glass. Wire glass is now made in all the varieties known to the rolled glass process, including rough or hammered, ribbed and figured glass. Wire glass is also polished like plate glass, giving an entirely clear and transparent glass, and is largely used in fireproof office buildings where there is any external exposure to fire.

The mechanical strength of plate glass is effectively increased by the introduction of the wire mesh, so that it will submit to much

greater strains, and in fact one of its first purposes and effects was to eliminate the necessity for using in skylights one-half inch glass, it having been proved that by using one-quarter inch wire glass all the requirements were met, the breakage risk decreased and a very large factor of weight and expense in structural material eliminated. See GLASS MANUFACTURING IN AMERICA.

WIRE NAILS. See NAILS.

WIRE ROPE, a variety of ropes of iron or steel wire extensively employed in raising and lowering apparatus in coal mines, as standing rigging for ships, as substitutes for chains in suspension bridges, and for telegraph cables. Endless wire ropes or cables are also used on traction railways, and in transmitting power over long distances where ordinary belting would prove unsuitable. A special type is used for the controls in aeroplanes. Wire ropes were used in 1822 for a suspension bridge at Geneva, and for a similar structure of great span at Freiburg in 1835. Their manufacture, however, is of extreme antiquity, a section of a four-strand wire rope 15 feet in length having been dug up at Pompeii. This rope was of bronze. A variety of machines are in use for making wire rope. The equivalents of round ropes of iron, steel and hemp are here tabulated:

Hemp		Iron		Steel	
Diameter in inches	Weight per foot, lbs.	Diameter in inches	Weight per foot, lbs.	Diameter in inches	Weight per foot lbs.
1½	1.16	½	.75	½	.39
2	2.00	⅝	1.40	⅝	.62
2⅛	2.66	1	1.80	¾	.89
3	3.16	1¼	2.45	⅞	1.20
3½	5.66	1½	4.15	1	2.00

Dimensions and Durability.— In the United States the wire rope generally in use is composed of a hemp centre around which are laid six strands of 7, 9, 12 or 19 wires, thus forming a rope of either 42, 54, 72 or 114 wires. Ropes with seven wires to the strand are generally used for elevators of all kinds, standing ropes, guys, transmission of power, etc. Ropes with nine wires are generally used for haulage ropes in mines, on inclines and for transmission of power. Those with 12 wires to the strand are generally used for shiprigging and 19 wires for hoisting. "Special flexible" rope has six strands of 37 wires each; and "extra flexible" has eight strands of 19 wires each. These ropes are employed in hoisting, on dredges, cranes, etc. The standard haulage rope has six strands with seven wires to the strand. "Running rope" has ordinarily six strands of 12 wires each. Wire rope is as pliable as hemp rope of equal strength and therefore can be operated over sheaves and drums of equivalent sizes and is far more durable and efficient. Durability of wire rope depends principally upon the diameter of the sheaves or drums; the greater the size of the sheaves or drums, the longer the rope will last. The rule commonly followed in wire transmission is that the minimum diameter of the sheave shall equal 100 rope diameters. Experience has demonstrated that the wear increases with the speed. It is therefore better to increase the load than the speed. One-fifth of the ultimate strength of rope is considered a fair working load. Five grades of wire rope are recognized according as they are made of iron, crucible cast steel; extra strong crucible cast steel; plow steel; and "Monitor" plow steel — an exceptionally high grade. Each of these may in a general way be regarded as 10 per cent stronger than the grade preceding it. The Monitor rope, however, is quite stiff in proportion to its diameter and requires a larger minimum sheave in operation. The following table shows the minimum diameters of the sheaves required for the more commonly used varieties of wire rope, and the safe load which the sizes named will bear in common usage. The table is based on crucible cast steel, as the material generally employed. Wire rope must not be coiled

Size, Inches	Haulage rope		Standard hoisting rope		Special flexible hoisting rope	
	Minimum diameter of sheave	Safe load, pounds	Minimum diameter of sheave	Safe load, pounds	Minimum diameter of sheave	Safe load, pounds
⅜	21 in.	1,000	12 in.	880		
½	27 in.	1,400	15 in.	1,240		
⅝	33 in.	1,800	18 in.	1,920	12 in.	1,600
¾	36 in.	2,200	21 in.	2,600	14 in.	2,200
⅞	42 in.	3,000	24 in.	3,360	16 in.	3,000
1	48 in.	4,000	27 in.	4,000	20 in.	3,800
1¼	53 in.	5,200	30 in.	5,000	21 in.	4,400
1½	60 in.	7,400	36 in.	7,000	23 in.	7,000
1¾	72 in.	9,600	42 in.	9,200	26 in.	10,000
1	84 in.	12,400	48 in.	12,000	30 in.	12,000
1¼	96 in.	14,800	54 in.	15,200	34 in.	14,000
1½	108 in.	18,400	60 in.	18,800	38 in.	18,000
1¾	120 in.	21,200	66 in	22,400	42 in.	22,000
1¾	132 in.	25,200	72 in.	25,600	45 in.	25,200

or uncoiled like a hemp rope. When not on a reel, roll on the ground like a wheel or hoop to prevent twisting or untwisting. Galvanized rope should never be used for running rope. To preserve wire rope under water or under ground, add one bushel of fresh slacked lime to a barrel of mineral or pine tar — boil and apply hot. On inclined planes the grooves of the pulleys or idlers should be lined with wood or babbitt metal. It is recommended to use as few idlers as possible. In a great many cases they do more harm than good. For transmission of power the sheves should be lined with leather or India rubber, to secure increased adhesion and prevent wear. The radius at the pit of the groove should always be greater than that of the rope, so that the latter drives only by friction in the bottom of the groove. The use of cast-steel rope is becoming general because of its lightness, greater strength and durability. To get the best results, steel rope should be made of the best quality of crucible cast steel. Ropes made from low grades of steel are inferior to iron ropes. The use of Bessemer steel in running ropes is not advisable. Ropes should be examined frequently and a new rope ordered before the old one is allowed to wear out. Attention to this will insure safety and prevent serious accidents.

Galvanized Steel Cables are largely used for suspension bridges and are composed of six strands with wire centre.

Diameter in.	Approximate circumference in.	Weight in pounds per foot	Approximate breaking strain in tons of 2,000 lbs.
2⅜	8¼	12.7	310
2¼	8	11.6	283
2⅛	7½	10.5	256
2	7	9.50	232
2⅛	7¼	8.52	208
2⅛	6¾	7.60	185
2	6¼	6.73	164
1⅞	5⅞	5.90	144
1¾	5½	5.10	124
1⅝	5	4.34	106
1½	4⅝	3.70	90
1⅜	4¼	3.10	75
1⅛	4	2.57	62

Galvanized Steel Hawsers are usually 37 wires to the strand and combine great strength with pliability. The demand for towing a number of heavy loaded barges, practically in all kinds of weather, has called for a wire hawser stronger than any Manila hawser made. The two grades presented in the table — Cast-steel and Special — are made with a hemp centre and six strands of 37 wires each, and of six 24-wire strands and seven hemp cores.

Approximate diameter in.	Circumference in.	Weight per foot lbs.	Approximate breaking strain in tons of 2,000 lbs.	
			Cast-steel	Special
2	6¼	6.25	128	166
1⅞	5⅞	4.85	101	131
1¾	5	4.00	84	109
1⅝	4¾	3.60	76	99
1½	4¼	2.90	62	81
1⅜	4	2.55	55	72
1⅛	3½	1.95	42	55
1	3	1.44	31	40

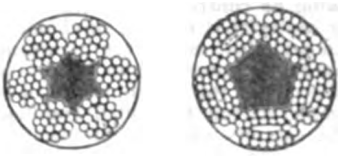
Flattened Strand Ropes.— Instead of being made up of strands of circular form in cross-section, flattened strand ropes are constructed with strands, each of which has one or more flattened surfaces, so that one flattened surface is exposed on the outside of the full length of rope, with the result that a plurality of wires in each strand must at all times take the wear instead of there being only one external wire in peripheral working in each strand, as is the case with ropes of ordinary construction while new. Until the wear has greatly advanced and consequently a considerable diminution of strength has taken place in an ordinary rope, the friction is borne in a very marked manner upon the crown of the one wire nearest the periphery of the rope in each strand, and in cases where small wire is used it is rapidly worn through, while heavier wire has a tendency to fracture where the abrasion has taken place. Owing to the number of wires that are at all times exposed to wear in a flattened strand rope for a considerable distance along their respective lengths, a smooth or comparatively smooth surface is presented even while new, and the wear is consequently light upon any individual wire and the tendency to become brittle is minimized. These ropes are exceedingly flexible and are less liable to the crushing action which frequently takes place in other ropes. They are made up with the wires in the strands and the strands in the rope laid in the same direction or reversely. Owing to the comparatively little wear which takes place in these ropes, so large a margin between working load and breaking strain is not required as in ropes of ordinary construction. Flattened strand ropes are free from all tendency to spin or kink and a considerable saving in wear of pulleys and sheaves is effected by their smooth surface which is shown in the two following illustrations:

New.

Worn.

The end sections show a comparison of structure and wearing surface of round and flattened strand rope.

A flat or ribbon-like form of this rope is made by laying as many strands as desired side by side, and "sewing" them together with a soft iron wire. The latter wears away and has to be renewed at intervals.



Hercules Wire Rope.— This is a very high grade of rope, the steel for which is specially prepared for it under a patent process and then the wire tempered and drawn by a patent process, producing a steel strong and tough and that is uniform in density, texture, elasticity, elongation and strength, every wire being carefully tested for these points and the tests registered for reference. It is a rope that was evolved originally for use in extrahazardous places and where there is liability for rough usage.

Non-Spinning Rope.— A special hoisting rope of 18 seven-wire strands, six of which are laid around the hemp core to the left and the other 12 outside of them around to the right. This rope will hold a load steady without twisting and spinning.

Aerial Wire Rope Tramways.— Aerial tramways may be used to advantage both in operation and construction for transporting material from one place to another. This is especially true with ores, coal, stone, lime, rock, gravel, earth, sand and cord wood. Packages, lumber, logs, light merchandise and water may also be transported economically. Usually the material is loaded on the cables at one terminal or an intermediate loading station and carried to the opposite terminal where it is discharged.

By means of various devices it can be arranged for the discharging of the material at any point along the line for use in such work as constructing dams, carrying refuse from plants, etc. Aerial trams can be constructed in a hilly country without the necessity of making tunnels, cuts, embankments or bridges as in railway construction. Rivers and ravines are spanned while hills and other constructions are overcome by building the line directly over them and supporting it by towers or derricks at the high points. Grades are no barrier to this construction as they can be built to surmount practically any grade and in fact where the loads are carried down grade and the grade is sufficient the entire tramway will be self-propelled, due to the forces of gravity. An aerial tramway is free from surface traffic, so that the underlying ground may be used for other purposes. Tramways are not affected by the elements, such as snow, sleet, rain or frost and may be operated irrespective of the weather.

There are two distinct classes of aerial tramways; namely, single rope systems and double rope systems. The single rope system is the simpler in construction and for limited capacity not exceeding eight tons per hour and an average condition of route, is economical in both construction and operation. This system consists of a moving endless rope to which are attached in various manners the carriers, buggies or buckets. The entire line is supported by sheaves placed on towers which are located according to the profile of the ground. At each terminal the cable passes around a horizontal sheave or series of sheaves, generally one of them being provided with grips in its periphery for driving or controlling the tramway. When divisible material is carried, mechanical loaders are used and the buckets are arranged so that they discharge automatically. This is all accomplished while the line continues in operation. Bulky material can be loaded and taken away from the carriers while the tramway continues in motion, owing to its slow speed. The double rope system is always preferable to a single system owing to the fact that a separate track rope or cable is used upon which the buckets travel, the other rope being exclusively for hauling. This diminishes and divides the strains developed greatly increasing the life of the cable and plant. The double rope system will fulfil almost any requirements in the tramway line and may be built practically any length. The practicability of long lengths of tramway is fully demonstrated by the tramway built for the North American Copper Company at Encampment, Wyo., which has a total length of over 16 miles and is built in four sections, making it the longest tramway in this country. Another notable cableway is that of the Saline Valley Salt Company at Bishop, Inyo County, Cal. It is 69,925 feet long and carries 20 tons of salt per hour from the floor of the valley over the Inyo Mountains 6,330 feet above that level to the line of the Southern Pacific Railroad on the other side. The track cables are 1¼ and 1⅛ inches for the loaded side and ⅞ inch for the returning empties. The traction rope is ¾ inch in diameter.

The longest cableway in the world is owned by the Argentine Republic and runs from the mining district of Mejicana, 11,500 feet high in the Cordilleras to the railroad station at Chilecito. The distance is 21.54 miles. The upper cables are 1 7/16 inches and the lower 1¼ inches in diameter. The hauling cable is 11/16 of an inch in diameter. The buckets have a capacity of 1,100 pounds each, and are spaced 1,500 feet apart. The cable is run at 400 feet per minute. The entire cableway is in eight sections, and is operated, or rather controlled by five engine plants. Once the cable is started by loading it runs continuously. Lubrication is accomplished by an oil car which is run over the line occasionally. The double rope system is capable of carrying capacities as great as 200 tons per hour and in fact even greater, when conditions demand it. The double rope system in general consists of two tracks or standing cables, upon which the loaded and empty carriers travel respectively and an endless traction rope for propelling them. The track cables are stretched at high tension, one end being anchored solidly and the other being fastened to a tension device. All of the cables are supported by towers, which are located according to the shape of the ground over which the line passes.

In all of the above classes, the traction rope passes around a sheave or a series of sheaves at either terminal; one, however, being generally provided with grips in its periphery for clamping the cable in order to secure the necessary friction for driving or controlling the tramway. In long lines, tension stations are provided at intervals, for dividing the tension and take up on the track ropes. Double rope systems may be subdivided into three classes. One in which the carriers are attached and detached to and from the traction rope by means of a friction or compressing grip. The second in which the carriers are permanent fixtures to the traction cable, the loading of same being effected by mechanical loaders while the buckets are automatically tripped at the discharging point. And the third in which the traction cable has permanent fixtures attached to it in the shape of clips or buckets. The buckets in this system are automatically attached and detached to and from the same at either terminal of the line by means of a locking device. This latter system is furthermore designed so that the buckets are automatically discharged at the unloading end without any attendants to look after them. A simple self-operating tramway which is known as a two-bucket tramway may sometimes be used to advantage where the grade is steep and where the capacity is moderate. This is true for short lines. It consists of two cables stretched parallel to each other, upon each being operated a bucket, the two buckets connected to a traction rope which passes around a sheave or series of sheaves at the upper end of the line. When the loaded bucket descends by gravity, it pulls up the empty bucket on the opposite cable and vice versa. This type is sometimes used on level ground or even up-grade simply by applying power to the line for operating. The most suitable system of tramways to be used in any case depends upon the profile of the ground, nature of the material to be transported and terminal requirements and these items should be investigated thoroughly before deciding upon any particular construction.

WIRELESS TELEGRAPHY. See TELEGRAPHY, WIRELESS.

WIRELESS TELEPHONY. See TELEPHONY, WIRELESS.

WIRT, wĕrt, **William,** American jurist and statesman: b. Bladensburg, Md., 8 Nov. 1772; d. Washington, D. C., 18 Feb. 1834. He received a grammar school education, became a private tutor, studied law, was admitted to the bar in 1792 and began practice at Culpeper Court House, Va. In 1799 he removed to Richmond, was elected clerk of the house of delegates and in 1802 received from the legislature the appointment of chancellor of the eastern shore of Virginia. In 1803 he published in the Richmond *Argus* his 'Letters of a British Spy,' purporting to be papers left at an inn by an English member of Parliament traveling in Virginia. They consist principally of sketches of prominent public orators, with remarks on eloquence and some pages of local description, and proved extremely popular. A second series appeared in 1808 in the Richmond *Enquirer* under the title of 'The Rainbow.' Wirt was an assistant in the prosecution of Aaron Burr and in the course of the trial displayed a learning and eloquence which established his reputation as one of the foremost lawyers in the country. A series of papers somewhat in the style of the 'Spectator,' begun by him and several of his friends in 1812 under the title of 'The Old Bachelor,' appeared in 33 numbers of the Richmond *Enquirer* and afterward in book form. His 'Sketches of the Life and Character of Patrick Henry' appeared in 1817 and became immediately popular. In 1816 Wirt was appointed by President Madison attorney of the United States for the district of Virginia and from 1817 to 1829 was Attorney-General of the United States. On his retirement he passed the rest of his life in the practice of his profession at Baltimore. In 1832 he was the candidate of the Anti-Masonic party for President of the United States. Consult Kennedy, 'Memoirs of the Life of William Wirt' (Philadelphia 1849); Trent, William P., 'English Culture in Virginia' (in "Johns Hopkins University Studies," Baltimore 1889).

WIRT, William Albert, American educator: b. Markle, Ind., 21 Jan. 1874. He was graduated at De Pauw University in 1898, later studied at the University of Chicago, and subsequently spent some time abroad studying the educational systems of England, France, Belgium and Germany. He was superintendent of schools at Redkey, Ind., in 1895–97; and in 1897 he became superintendent at Bluffton, Ind. There he put into practice his own theories of educational methods with marked success, attracting widespread attention among educators. He became superintendent of schools at Gary, Ind., in 1907; and in 1914 he was appointed expert adviser to the New York boards of education and of estimate in the reorganization of the New York City schools. His work in New York was branded as anti-democratic and anti-American and the city administration which employed Wirt was repudiated at the polls largely on the "Gary plan" issue. His method is known both as the Gary plan and as the Wirth Plan. See *Gary Plan* under EDUCATION, ELEMENTARY.

WISCASSET, Me., town, county-seat of Lincoln County, on the Sheepscot River, and the Maine Central Railroad, 40 miles northeast of Portland. It is in a region noted for picturesque scenery and is a popular summer resort. It has a good harbor and is a port for coasting vessels; some vessels are built here, and the town also contains a shoe factory and large saw-mills. There is a national bank, capital $100,000, and a savings bank. It has several elementary schools and a public academy (high school) founded in 1877. Pop. about 1,287.

WISCONSIN, wis-kŏn-sĭn, a north-central State of the United States, popularly called the "Badger State," between lat. 42° 30′ and 47° 50′ and 92° 54′ west. It is bounded on the north by Lake Superior and the upper peninsula of Michigan, on the east by Lake Michigan, on the south by Illinois and on the west by Iowa and Minnesota. The extreme dimensions of the State are about 320 miles from north to south and 295 miles from east to west. The gross area is 56,066 square miles, 810 of which are covered with water. In addition the State has political jurisdiction over 9,878 square miles of water area in the adjoining lakes, Superior and Michigan. The population in 1910 was 2,333,860. Of this total 1,820,000 or 78 per cent were native born and 513,000 or 22 per cent were foreign born. There were 10,142 Indians, 2,900 negroes and 263 Japanese and other races.

Geography, Climate.— Wisconsin's position as one of the States of the upper Mississippi Valley, adjoining the Great Lakes, constitutes its chief geographical asset. Located about one-third of the way from the Atlantic to the Pacific, the climate is continental in character, the winters being relatively cold and the summers rather hot. The mean annual temperature is about 43° Fahrenheit. The extreme range is from 110° above to 50° below zero. The daily range is about 18° in summer and 14° in winter. The summer temperature corresponds to that of France, Germany and southeastern England; the winter temperature to northern Sweden and central Russia.

The Wisconsin and Fox rivers, separated by an interval of less than a mile in south central Wisconsin and emptying respectively into the Mississippi River and Green Bay, constitute a great water trough across the State from northeast to southwest. The geographical characteristics of the smaller and southeastern of the two sections into which the State is thus divided differ markedly from those of the larger, northwestern section; these differences have had a marked effect upon the historical development and present condition of the State. The eastern and northern portions of the State drain into Lakes Michigan and Superior by short streams with rapid courses. The western and southern portions (much greater in area) drain into the Mississippi by a number of large rivers. The portion of the State above the Fox-Wisconsin water-trough was originally heavily wooded and relatively inaccessible. The southern and eastern section was relatively open and comparatively accessible to settlers. Accordingly this region was settled first and is to-day much further advanced industrially than is the northern section. The latter, as late as the admission of Wisconsin to statehood, was commonly regarded as a worthless wilderness, and even to-day retains to a large degree the characteristics of a frontier region.

476	Wauseka	E 9
341	Welcome, Outagamie	J 7
6,645	West Allis	J 10
2,462	West Bend	J 9
902	Westby	E 8
729	Westfield	H 8
327	Weston	B 6
840	West Salem	D 8
967	Weyauwega	I 7
371	Weyerhauser	D 5
542	Whitefish Bay	K 9
703	Whitehall	D 7
3,224	Whitewater	I 10
551	Wild Rose	H 7
510	Wilton	E 8
940	Winneconne	I 7
443	Withee	E 6
1,090	Wittenberg	H 6
789	Wonewoc	F 8
525	Wrightstown	J 7
425	Wyocena	H 9

manufacturing in Wisconsin, the decline in value in recent years of the annual output of rough lumber being more than counterbalanced by the increased attention paid to more advanced and specialized manufacture of forest products. In 1914 the total value of the wood products of the State exceeded $109,000,000, made up of lumber, rough and finished, $55,000,000; pulp and paper, $31,000,000; furniture, $22,000,000.

The foremost manufacturing industry is dairying, already treated in connection with agriculture. The manufacture of foundry and machine-shop products comes next after forest products, having enjoyed a remarkable growth in recent years. The figures for 1914 show an annual output of over $60,000,000. The chief centre of this industry is Milwaukee and the other cities along the southern coastline of Lake Michigan. Their location on Lake Michigan within easy reach of the network of railroads centring at Chicago affords them superior transportation and marketing advantages. The dairying industry is, of course, widely diffused over the State, although even here a tendency toward centralization is becoming manifest. Next in importance is the manufacture of leather, the output in 1914 being worth over $42,000,000. The development of the leather industry is due to the abundant supplies of oak and hemlock bark provided by the forests of the State. The tanneries, formerly widely distributed, are now largely centred in a few cities in the eastern part of the State. In output of leather Milwaukee leads all the cities of the United States. Malt liquors closely follow after leather, the output in 1914 being valued at almost $41,000,000. Flour and grist mill products in 1914 were worth nearly $29,000,000. In both these industries a high degree of centralization prevails, modified to some extent by the existence of numerous small mills and breweries scattered over the State. Milwaukee produces more beer than all the remainder of the State and ranks as the second brewing centre in the country. Popular opinion to the contrary, however, brewing is not Milwaukee's first or even its second industry in point of importance. Slaughtering and meat packing has grown rapidly in recent years, the industry being centred chiefly at Milwaukee and other nearby cities. The output for 1914 was valued at $32,000,000. The paper and wood pulp industry is increasing rapidly. In 1914 the output was valued at $31,000,000, and Wisconsin ranked fourth among the States with respect to this industry. Flour and grist mill products are slowly declining in importance; their value in 1914 was $28,700,000, about $3,000,000 less than in 1909. Other important and growing manufacturing industries are those of agricultural implements, in which Wisconsin ranked second in 1914, automobiles and boots and shoes. Over one-third (in value) of the manufactured products of the State are made at Milwaukee, and fully four-fifths of the total in the southeastern quarter of the State. Milwaukee has become one of the chief manufacturing centres of the Union, ranking first in leather, second in liquor and malt, third in foundry and machine-shop products, and tenth in total value of manufactures.

The United States Census Bureau figures for 1914 credited Wisconsin with 9,104 manufacturing establishments, in which over 230,000 persons were engaged. The capital investment was $754,000,000, salaries and wages paid amounted approximately to $150,000,000, and the total value added to raw materials through processes of manufacture was estimated at $277,750,000.

Banking.— No subject caused more prolonged discussion at the time the State constitution was adopted than did that of banking. Largely because of the extreme measures with regard to banking contained in the first constitution, that instrument was rejected by the voters. The second constitution drafted therefore, was more liberal toward banks and banking, and a general banking act was passed in 1892. In 1903 a State banking department was created, in charge of a commissioner of banking. Private banks were legislated out of existence, and State banks were required to be twice examined and to make five reports yearly on call to the bank commissioner. At the close of 1916 there were 737 State banks and trust companies as compared with 240 in 1896. There were also 138 national banks at the close of 1916. The following summary exhibits the principal items concerning the banks of the State at that time:

ITEM	National banks, 133	State and savings banks and trust companies, 737
Capital	$18,468,000 00	$23,672,350 00
Surplus	8,137,000 00	7,490,949 51
Undivided profits	5,058,000 00	5,249,601 00
Resources	253,560,000 00	298,617,175 61

During the year 1916 there was an increase in the total banking power of the State of $82,000,000, an amount almost equal to the total assets of the State banks in 1902.

Transportation.— The advantage which the State derives from the transportation facilities afforded by Lakes Michigan and Superior has already been adverted to. On the west the Mississippi borders the State for 250 miles and is navigable throughout the distance. The pioneer hopes of a widely developed system of intrastate water transit have not been realized. Nevertheless the rivers of the State have proved of vast importance as affording a means to float the lumber to market. All four of the State's well-developed manufacturing areas owe their prominence, either directly or indirectly, to the transportation advantages afforded by its river and lake systems. These areas are (1) the Lake Michigan shore line; (2) the Fox River Valley; (3) the Rock River Valley (including Madison); and (4) the upper Wisconsin Valley. Railroad building in the State was begun in 1851, the first line to cross it being laid from Milwaukee to Prairie du Chien in 1851–57. In the early period of railroad development it was believed that the most important routes would run east and west, connecting Lake Michigan with the Mississippi River, and the second line to cross the State was early built from Milwaukee to La Crosse. The decline in importance of river commerce, together with the development of Chicago and Milwaukee near the southern end of Lake Michigan and Saint Paul and Minneapolis on the upper Mississippi, have given a pronounced northwest-southeast trend to the transportation lines of the State. In 1915 the State had a main track mileage of 7,518, over 5,000 miles of this total belonging to the Chicago and Northwestern, the Chicago, Mil-

waukee and Saint Paul, and the Minneapolis, Saint Paul and Sault Sainte Marie systems. In 1911 a state highway commission was created and a scientific and far-reaching system of highway improvements was begun. As yet in its infancy, relatively speaking, by the close of 1916 nearly 5,000 miles of improved highway had been constructed at a cost of almost $18,000,000; work is progressing in accordance with a comprehensive system which will ultimately reach every county-seat in the State and almost every village or town of any considerable importance. Economically, socially and otherwise such a system of highways will be second in importance only to that of the railway system of the State.

Government.—The constitution under which Wisconsin was admitted into the Union in 1848 is still in force, although a number of amendments have been made in the 70 years of its operation. Amendments must originate in the legislature. Upon approval by majority vote of the members of each house in two succeeding legislatures they must be submitted to the electorate, which approves or rejects them by majority vote. To call a constitutional convention the question of holding one must be submitted, by legislative vote, to the voters at the election of the succeeding legislature and a majority vote must be given in its favor. The legislative power is vested in a bicameral legislature consisting of a senate and an assembly. The assembly must never number less than 54 nor more than 100 members; the senate must not have more than one-third nor less than one-fourth as many members as the assembly. At the present time the assembly consists of 100 members and the senate of 33. Regular sessions of the legislature are held biennially, in the odd-numbered years. The governor is the chief executive officer of the State, and has a limited veto power over acts of the legislature. Other executive officers are a lieutenant-governor, secretary of state, treasurer, superintendent of public instruction and attorney-general. All of these except the lieutenant-governor receive an annual salary of $5,000. In recent years, due to the progressive movement led by R. M. La Follette (now United States senator for Wisconsin), a number of powerful commissions have been established, and these are quite as important elements of the administrative system of the State as any of the older offices already noted. The more important are the industrial, tax and railroad commissions, each consisting of three members with annual salaries of $5,000. Other important commissions and departments are the free library, conservation, civil service and highway commissions, the engineering, banking, insurance and agricultural departments, the State board of control, the State board of public affairs and the State Historical Society. The judicial power of the State is vested in a Supreme Court, Circuit Courts, courts of probate and justices of the peace. Supreme Court justices are elected for 10-year terms, but in practice sitting justices are usually re-elected, commonly without opposition. Circuit and probate judges are elected for six and four years, respectively, and justices of the peace for two years. The full right of suffrage is granted to all male citizens of the United States of 21 years of age and upward and to those of foreign birth who prior to 1 Dec. 1908 declared their intention to become citizens of the United States who have resided in the State one year and in the election district 10 days. Woman suffrage exists as yet only in connection with questions pertaining to schools. Wisconsin was one of the first States to adopt a direct primary law for the nomination of party candidates for office. A comprehensive corrupt practices act eliminates many of the evils attendant upon partisan contests with which the State was formerly familiar. Candidates for office must file at suitable intervals sworn statements of their receipts and expenditures, all political advertisements must be accompanied by a statement concerning their cost and who pays it, and the purposes for which candidates may spend money are limited. Cities are governed by general or specific charters. The commission form is permitted and has been adopted by a number of the cities. It seems not to be gaining ground, however, and one city which operated under it for several years has returned to the old form of government by mayor and council. The towns are governed by officers elected by the voters assembled in annual town meeting. Counties are governed by a county board, composed of representatives from the several towns and by the following administrative officers: clerk, sheriff, treasurer, district attorney, coroner, clerk of Circuit Court, register of deeds, surveyor and superintendent of schools.

Finance.—The framers of the State constitution were concerned above all things lest the State be plunged into debt. Stringent safeguards were, therefore, devised to prevent this, and prior to 1918 there was no formal State debt. However, what in effect amounted to one of slightly over $2,000,000 existed, being the obligation of the State toward its own several educational funds, the principal of which had been devoted to the extraordinary expenditures of the Civil War. In 1915 a beginning was made of paying off this debt at the rate of $100,000 a year. In March 1918, a law passed authorizing the issuance of $1,000,000 in State bonds to defray expenses incurred in equipping Wisconsin soldiers for service in the Great War. The chief sources of revenue are taxes on corporations, inheritances and incomes. With respect to the latter form of taxation, Wisconsin is a pioneer among the States of the Union. For the year ending 30 June 1916, the total income tax assessed was $3,837,370.04. Personal property tax offsets were allowed to the amount of $1,825,641.62, and the amount of cash actually collected was $1,906,441.69. Ten per cent of the income tax goes to the State government, the remaining 90 per cent to local governmental units. During the same year the general property tax levy amounted to $43,365,000, the corporation tax to $6,517,000, and the inheritance tax to $502,000, the total taxes paid for all governmental purposes being in excess of $52,000,000. Of the general property tax, 10 per cent went to the State government, 20 per cent to the counties, 41¼ per cent to local governments, and 28¼ per cent to schools.

Charitable and Correctional Institutions.—The charitable and correctional institutions are

administered by the State Board of Control. It has supervision, among other things, over the insane, whether in State or county hospitals, over the county tuberculosis sanitaria, poorhouses, police stations and jails; and, subject to the governor's approval, acts as a board of parole. There are two State insane hospitals (at Oshkosh and Mendota) and 35 county hospitals. There is one State tuberculosis sanitarium at Wales and nine county sanataria. At the State sanitarium were 187 patients in 1916, maintained at a weekly cost of $11.42 for each. The two State insane hospitals together had 1,262 inmates in 1916 supported at a weekly per capita cost of about $5. The Wisconsin State Prison at Waupun had 906 inmates whose weekly support cost $3.80 each. Other State institutions include a home for feeble-minded at Chippewa Falls, a school for the blind at Janesville, school for the deaf at Delavan, a State reformatory at Green Bay, an industrial school for boys at Waukesha, and an industrial home for women at Taycheedah. At the State prison a binder plant is maintained, and convicts are employed in road building. The cost of maintaining the several charitable and correctional institutions of the State for the year ending 30 June 1916 was $1,294,449. Their total number of inmates at the close of that year was 4,824.

Population.— For a rural State the population of Wisconsin represents a high degree of racial intermixture. In 1850, two-thirds of all the Norwegians of the country lived in Wisconsin. They are still one of the most important elements of the population, although Wisconsin is no longer the leading Scandinavian State. From the beginning the German element has been strongly represented, and at the present time after the native Americans, it constitutes the chief racial element of the State. The German element is stronger in Wisconsin than in any other State of the Union, and Milwaukee is probably more strongly Teutonic than any other important American city. There are important Slavonic settlements in Milwaukee and in central Wisconsin, Dutch settlements in Brown, Sheboygan and other counties, and Swiss settlements in Green and adjoining counties. In the latter section dairying has become the dominant industry, and more Swiss cheese is manufactured here than anywhere else in the United States. In 1840 Wisconsin had a population of 30,945. From 1840 to 1850 the population increased 10 fold, and from 1850 to 1860, two and one-half fold (775,881 in 1860). In the 50 years from 1860 to 1910 there was a fairly regular increase of slightly over 300,000 per decade, the population in 1910 being 2,333,869. This absolute rate of increase is supposed to have held for the five-year period ending 1915, the estimated increase during this time being 140,000. Thus, the absolute increase in population per decade has remained practically constant for 75 years (1840–1915), while the ratio of increase to total population has constantly decreased. In 1910 the State had eight cities of 25,000 or over, and 10 more with population in excess of 10,000. Of the total population 1,820,000 or 78 per cent were native born and 513,000 or 22 per cent were foreign born.

Religion.—The last census reported 1,000,000 church members in Wisconsin divided among 38 denominational bodies and 4,902 churches. Slightly over half of the total church membership is Roman Catholic. More than one-fourth is Lutheran. Next in numerical order are the Methodists with about 6 per cent, and the Congregationalists with 2½ per cent of the total church membership. No one of the remaining 34 denominations possesses as many as 25,000 members.

Education.— Notwithstanding the diverse racial elements and the predominantly rural type of population, the school system of Wisconsis is the chief glory of the State. At its apex stands the University of Wisconsin at Madison, superbly located on Lake Mendota, with grounds stretching for several miles along the shore. It is housed in some 40 main buildings valued at several million dollars. In the year 1916–17 there was a faculty enrolment of 600 and the student enrolment was close to 8,000. With our entrance into the Great War in 1917, however, came a heavy decrease in numbers, both of faculty and students. The university is built around the College of Letters and Science, and includes a graduate school, law, engineering, medical, music, agricultural, library, pharmaceutical and extension divisions and schools. To a greater extent, probably, than any other American university, the University of Wisconsin has made its interests identical with those of the people composing the commonwealth. There are nine State normal schools, located at Milwaukee, River Falls, Stevens Point, Whitewater, Platteville, Eau Claire, La Crosse, Superior and Oshkosh. Their administration is entrusted to a single Board of Normal School Regents, corresponding to the Board of Regents of the University; while the State Board of Education correlates, on the business side, the higher educational interests of the State. The more important privately-supported colleges of the State are Lawrence, at Appleton; Ripon, at Ripon; Beloit, at Beloit; Carroll, at Waukesha; Campion, at Prairie du Chien and Milwaukee-Downer (for women) and Marquette University at Milwaukee. There is an excellent system of public, high and graded schools, with suitable provision for State aid and State supervision. In 1915–16 there were 47,000 pupils enrolled in the 353 public high schools, an increase of 74 per cent in 10 years. Since the Catholic population of the State outnumbers that of all other religious denominations combined, there is a large enrolment of pupils in the numerous church schools who would otherwise go to the public schools. The number of ungraded rural schools is decreasing slowly, while the proportion of total school population in attendance upon graded schools is steadily and rapidly increasing. In 1915–16 continuation schools in 29 cities enrolled 36,700 pupils at a per capita cost of $12.45. In 1915–16, with a total population of school age of 801,995 in the State, 516,990 were enrolled in the several classes of free public schools and about 70,000 (by estimation) in private and parochial schools. For nearly a quarter of a century the State has had an admirably organized system of library supervision and leadership, with the result that the people of Wisconsin probably enjoy more adequate library service than do those of any

other state. The traveling libraries sent out by the Free Library Commission penetrate to every corner of the State; while the resources of the State Historical Library with its more than 400,000 titles and the University Library with 275,000 more are at the disposal, under reasonable administrative regulations, of every resident of the State.

History.—The territory now embraced in Wisconsin has belonged successively to Spain, France, Great Britain and the United States. The Spanish rule was theoretical rather than actual, and need not be dwelt upon in this sketch. The French rule dates from the advent of French explorers on the Upper Lakes, about the middle of the 17th century. The first white explorer known to have visited Wisconsin was Jean Nicolet, who in 1634 came to the shores of Green Bay, seeking there the fabled civilization and wealth of distant China. Three decades later Jesuit missions were established at Lapointe on Lake Superior and at Depere on Green Bay. In 1673 Jolliet and Marquette crossed Wisconsin by the Fox-Wisconsin River route on their famous journey of discovery of the upper Mississippi. Thenceforward for 150 years Wisconsin was the haunt of the fur trader and the abode, as in primeval times, of the red man. As an outpost of New France it shared the economic and political fortunes of that colony. As early as the War of the Spanish Succession Frenchmen and Indians from Wisconsin made the long journey to Lower Canada to participate in the war against the Iroquois and the English. Wisconsin Indians assisted in the massacre of Braddock's army near Pittsburgh in 1755, and elsewhere throughout the ensuing war with the English. The British régime, beginning upon the overthrow of New France in 1763, nominally lasted until the Treaty of Paris of 1783 or (from another point of view) until the cession of the British posts in the Northwest in 1796. Actually, however, the English held practically full sway over the Indian and French population at least until 1816, when the United States at length definitely asserted its authority by establishing regular army posts at Green Bay (Fort Howard) and Prairie du Chien (Fort Crawford). Nominally, however, Wisconsin by the Ordinance of 1787 became a part of the Northwest Territory. Upon the admission of Ohio to statehood, as a portion of the remainder of the original Northwest Territory, Wisconsin became a part of the new Indiana Territory. In 1800 it fell under the jurisdiction of Illinois Territory, and upon the admission of Illinois to statehood in 1812 was added to Michigan Territory. Here it rested until 1836, when Michigan became a State, and Wisconsin Territory itself was organized, with boundaries including all of modern Iowa and Minnesota and much of North and South Dakota. The greater part of this dominion was shorn away by the erection of Iowa Territory from its southern and western portion in 1838, and 10 years later Wisconsin, with its present boundaries, became a State of the Union. Following the War of 1812, for a decade and a half Wisconsin remained dedicated to savagery and the fur trade. The Black Hawk War of 1832, however, broke for all time the Indian domination of the State. Already the lead mine region of southwestern Wisconsin was being exploited by hardy miners, chiefly from Illinois, Missouri and Kentucky, and close upon the Black Hawk War came a tide of settlement. Cities sprang up like magic, farming communities were developed almost over night and an era of hopeful speculation and laborious settlement ensued. In 1830 the census returns showed a white population of slightly over 3,000, wholly confined to the lead mines and the old French settlements of Green Bay and Prairie du Chien. In 1840 there were 30,000 (in round numbers) and in 1850, 300,000. Milwaukee in 1835 contained three families of white affiliations; in the summer of 1836 town lots were selling at $2,000 and more. The wild boom shortly burst, of course, but there are men still living who have witnessed the growth of Milwaukee from a village of 1,000 population to the present city of almost half a million.

Thus in the generation from 1830 to 1860 the Wisconsin wilderness was transformed into a thriving American commonwealth of three-quarters of a million souls. The virgin resources of soil and forest were tapped, the framework of government and society was firmly erected. The frontier State—still a wilderness at the time of South Carolina's nullification ordinance in 1832—in the Civil War poured over 90,000 soldiers into the South to assist the war for the preservation of the Union. When admitted to statehood in 1848 Wisconsin was a typical frontier commonwealth, and the citizens were for the most part ardent Democrats. Despite the existence in southwestern Wisconsin of a strong element of southern origin, the progress of the anti-slavery dispute in a few years broke the power of the Democratic party. In 1854 at Ripon was enacted one of the earliest movements looking to the organization of the new Republican party. In 1856 a Republican governor was elected. Since that date the Republican party has dominated the State electing every governor but three, and carrying every presidential election but one. The outstanding political feature of recent years has been the cleavage in the Republican party brought about during the 90's by reason of the progressive reform movement led by Robert M. La Follette. The forerunner by more than a decade of the national cleavage in the party which culminated in the presidential campaign of 1912, for years was enacted on the Wisconsin political stage the bitter struggle between "Stalwart" and "Half-breed" with which the entire nation became familiar when, in the arena of national politics, the conflict between "stand pat" and "progressive" Republicans was joined. For over a dozen years La Follette dominated the State, serving as governor from 1901 to 1906 and as United States senator from 1906 to the present time. During the earlier years of this period a comprehensive series of progressive measures were adopted looking to the liberalizing of the agencies of government and society, until Wisconsin became a synonym for political experiment and progress. The Presidential campaign of 1912, however, rent in twain not only the national Republican party but the La Follette branch of the party in Wisconsin as well. Taking advantage of the factional feuds which had developed in the ranks of their opponents, the conservative Republicans in the election of 1914 once more gained

versity now includes the following colleges and schools: (1) the College of Letters and Science; (2) the College of Mechanics and Engineering; (3) the College of Law; (4) the College of Agriculture; (5) the Graduate School. It also conducts a summer school and a university extension department. The College of Letters and Science includes besides the general departments of instruction in arts and sciences, the several special departments as follows: The courses in chemistry, commerce, journalism and pharmacy, the School of Music, the Medical School, the Library School, the School of Education, the normal graduates' course and the Washburn Observatory. The degrees of A.B. and Ph.B. (general course) are conferred upon the graduates of the College of Letters and Science, except in the chemistry, medical and pharmacy courses which lead to the B.S. degree, and the normal graduates' course, leading to the degree of Ph.B. (course for normal-school graduates). For the degree of Ph.B. (general course), special emphasis is placed on mathematics, philosophy and science; for the A.B. degree, the work is largely elective. In the freshman year, an English course is required and during this year the other studies are elected from two groups, (1) language, (2) mathematics, science and history. Certain minima in these groups must be offered, the total covering somewhat less than two years' work. Not later than the beginning of the junior year a major subject in some one department must be elected and the remainder of the work is free electives. A limited amount of elective work may be taken in the colleges of Engineering and Agriculture, in the School of Music or in the special courses of the College of Letters and Science. A special two years' course is arranged for normal-school graduates, for completion of which the degree of Ph.B. (course for normal-school graduates) is conferred. The special courses in pharmacy cover four years, leading to the degree of B.S., or two years, leading to the degree of graduate in pharmacy. The College of Engineering was organized in 1870; it offers five four-year courses, leading to the degree of B.S.; these are in chemical, civil, electrical, mechanical and mining engineering. The above courses may be taken as five-year courses with the B.S. degree; this allows more elective work in the other colleges. By proper arrangement of elective studies, students in the College of Letters and Science secure the A.B. degree at the end of four years and the B.S. degree in engineering in two additional years. The College of Agriculture offers a "long course" and a home economic course of four years, leading to the degree of B.S., a short course of two years, winter and summer dairy courses and a farmers' winter course; this college also includes the agricultural experiment station and the organization of farmers' institutes. The College of Law was established in 1868; it offers a three-years' course, leading to the degree of LL.B. The Graduate School received its present organization in 1895. It includes work in the College of Letters and Science, the College of Engineering and the College of Agriculture, courses especially for graduate work being offered in each department of these colleges; the school as a whole is under the control of a faculty committee. The degrees conferred are A.M., M.S., M.Ph., Ph.D., C.E., E.E., M.E., Ch. E. and Min. E. The Summer School offers courses in the subjects of the general college curriculum, in education, in gymnastics and a special normal course; it also includes a summer school in shop and laboratory work for mechanics. Tuition in the university is free to Wisconsin students. There are 115 scholarships for undergraduates and 15 student loan funds; there are also 43 fellowships, 24 honorary fellowships and 36 graduate scholarships, most of which are in special departments in the various colleges of the university. In addition, legislative scholarships are granted to the extent of 8 per cent of the nonresident enrolment of the previous year.

Gymnasium work and military drills are required of men students during part of the course, and gymnasium work of women students. There is also ample provision for athletic sports, which are under the general control of an athletic council, on which faculty, alumni and students are represented. The University of Wisconsin is the only institution of the kind in the West which has a boat crew. The women students have organized an athletic association. The students maintain four men's literary societies and two women's societies; three of the men's societies are in the College of Letters and Science and one is in the College of Agriculture. The men's societies have organized a forensic board which selects debaters for intercollegiate contests. Two of the men's societies and one women's society were organized in the early days of the university and have always had a prominent part in student life. There are also a science club, Sigma Xi, composed of faculty members and graduate students, four dramatic societies and innumerable other student associations, a Woman's Self-Government Association and chapters of Phi Beta Kappa and Tau Beta Pi (engineering). There are several other honorary and professional fraternities in agriculture, commerce and economics, chemistry, engineering, medicine, debating, law, journalism and home economics. The university campus contains about 450 acres, bordering on the south shore of Lake Mendota; in the eastern part of the grounds the land rises abruptly in two hills, of which the eastern and higher is known as University Hill. On this hill are most of the college buildings; the Washburn Observatory stands on the western hill, which is known as Observatory Hill; farther west is the farm with its barns and buildings; to the east of University Hill is the lower campus, used largely for athletic sports; the State Historical Society Library building, containing the libraries of the society and the university, also stands at the western end of this campus. Among the prominent buildings on and near the University Hill are north hall, south hall, biology building, chemistry building, law building, physics-economics building and university hall, Chadbourne hall, Barnard hall, Lathrop hall, music hall, science hall and the engineering building; on and near Observatory Hill are the Hiram Smith hall (dairy), horticultural building, agricultural hall, home economics-extension building, the infirmary, stock pavilion, soils building, agricultural engineering building, agri-

cultural chemistry building and agronomy building. The university library in 1919 contained 263,000 volumes, in addition to which there are departmental libraries, the State historical library and legislative reference library open to students. Thus there are about 581,000 volumes and 308,000 pamphlets accessible for the purposes of the university. The collection is particularly strong in American and English history, Greek, political and social science, Shakespeare and the publications of American learned societies. The students in 1916–17, the last normal year before the war, numbered 5,318, of whom 3,417 were in the College of Letters and Science, 657 in the College of Engineering and 929 in the College of Agriculture. In 1918–19 there were 4,173 students, with 2,884 in the College of Letters and Science, 599 in the College of Engineering, and 531 in the College of Agriculture. Including the Students' Army Training Corps, the total enrolment was 5,274. The University of Wisconsin ranks among the first of the State universities both in numbers and in standard of scholarship.

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WISCONSIN PHALANX. See RIPON, WIS.

WISDOM, Book of, the name of one of the so-called apocryphal books of the Protestant Bible. See WISDOM OF SOLOMON.

WISDOM OF SOLOMON, a book regarded by Protestants as apocryphal, but accepted by Roman Catholics as part of the canon of the Old Testament. It purports to be the work of Solomon, but the Protestant view is that it was the composition of a Jew of Alexandria about a century before Christ. The author states that he is a king and the son of a king, that he prayed to God for wisdom, and received both wisdom and riches. God directed him to build a temple on the holy mount. Righteousness and wisdom are commended, unbelievers and idolatry are denounced, and examples are given from the Mosaic writings to show how the judgments of God overtake the worshippers of false gods and the wicked generally. Nor is the author content with indicating earthly penalties for wrongdoers. He points plainly to rewards in a future life for the good, and punishments for the wicked, and without referring to the resurrection of the body, he teaches the immortality of the soul. The book was highly esteemed among the Jews and was evidently well known to Saint Paul, as the epistles to the Romans, the Corinthians and Ephesians indicate. Under the name of 'Wisdom' in the Roman Catholic canon of the Old Testament, the book is in the list recognized by the Council of Trent as inspired Scripture. The Roman Catholic position is that it was truly the work of Solomon, and that the Alexandrian Greek version was a translation from the original Hebrew. See APOCRYPHA; BIBLE.

WISE, Bernhard Ringrose, Australian statesman and author: b. Sidney, 10 Feb. 1858. He was educated at Rugby and Oxford, where he was several times prizeman, founder of the Amateur Athletic Association of Great Britain, and first president of the Oxford Union and Athletic Club. From 1879 to 1881 he was amateur mile champion. After graduating in law he went to New South Wales, where he was Attorney-General (1887–1904) and Minister of Justice (1901–04). He was a member of the national committee which framed the constitution of the Commonwealth, and he was very active in promoting industrial law reform and prison reform. He is the author of 'Industrial Freedom' and 'The Commonwealth of Australia.'

WISE, Daniel, American Methodist clergyman and author: b. Portsmouth, England, 10 Jan. 1813; d. Englewood, N. J., 1898. He came to the United States in 1832, entered the Methodist ministry, edited the *Sunday School Messenger*, 1838–43, and *Zion Herald*, 1852–56, as well as many Sunday School publications. He published more than 50 books for young people, mostly under the pen-names of "Francis Forrester" and "Laurence Lancewood." Among these are 'Personal Effort' (1841); 'Life of Ulric Zwingli' (1850); 'My Uncle Toby's Library' (12 vols., 1853); 'Vanquished Victors' (1876); 'Heroic Methodists' (1882); 'Boy Travelers in Arabia' (1885); 'Men of Renown' (1886); and 'Some Remarkable Women' (1887).

WISE, Henry Alexander, American lawyer and political leader: b. Drummondtown, Accomac County, Va., 3 Dec. 1806; d. Richmond, Va., 12 Sept. 1876. He was graduated from Washington College, Pa., in 1825, was admitted to the bar in 1828 and began the practice of law at Nashville, Tenn. In 1830, however, he returned to Accomac County, where he built up a large practice as a lawyer. He was early active in the Democratic party; was a delegate to the National Convention of 1832, and in the same year was elected to Congress. After the election he fought a duel with his opponent, on the latter's challenge. On the removal of the government deposits from the United States bank, Wise, with other Democrats in the House, joined the Whigs in opposition against President Jackson. He was, however, re-elected to Congress in 1834 and in 1836; and also opposed Van Buren's banking and sub-treasury plan. In 1837 he acted as the second of Graves, of Kentucky, in a duel with Cilley, of Maine, both members of Congress, in which the latter was killed. This occurrence led to much denunciation of Wise, who was, however, ascertained not to be responsible for the affair. In 1840 he was instrumental in securing the nomination of Tyler for the Vice-Presidency, and after Tyler became President exerted an important influence on the administration policy. In 1844 he was appointed Minister to Brazil; and on his return to the United States in 1847 again gave his support to the Democratic party. In 1855 he was Democratic candidate for governor of Virginia, conducted an active campaign, particularly against the Know Nothing party, and was elected by a majority of 10,000. Toward the end of his term as governor occurred the seizure of Harper's Ferry by John Brown and his followers, and the execution of John Brown at Charlestown, 2 Dec. 1859, was one of the last acts of his administration. He was a member of the State convention which met at Richmond in 1861 to consider the relations of Virginia to the Federal government, and one of

the committee on Federal relations to whom the principal business of the convention was referred. He favored a compromise between North and South, and the avoidance of hostilities if possible; but after Virginia declared for secession he loyally supported the Confederate cause. He was appointed a brigadier-general in the Confederate army and occupied the Kanawha Valley, but was rapidly driven out by General Cox in a series of skirmishes. He continued to serve in western Virginia until he was sent to Roanoke Island, N. C., with instructions to defend it. At the time of the attack upon the island by General Burnside, in February 1862, he was ill on the mainland, but the greater part of his brigade, known as the "Wise legion," took part in the action. He was later at the battle of Appomattox. After the war he resumed the practice of law in Richmond. He wrote 'Seven Decades of War' (1872). Consult Wise, B. H., 'Life of Henry Alexander Wise' (1899); Wise, J. S., 'End of an Era' (1899).

WISE, Henry Augustus, American naval officer: b. Brooklyn, N. Y., 12 May 1819; d. Naples, Italy, 2 April 1869. He entered the navy as midshipman in 1834, served on the Florida Coast during the Seminole War and on the Pacific Coast during the Mexican War. He became assistant chief of the Bureau of Ordnance and Hydrography in 1862, remaining in that capacity during the balance of the Civil War. He was promoted captain in 1866. Under the pseudonym of "Harry Gringo" he wrote 'Los Gringos; or, An Interior View of Mexico and California, with Wanderings in Peru, Chili, and Polynesia' (1849); 'Tales for the Marines' (1855); 'Scampavias, from Gibel-Tarek to Stamboul' (1857); 'The Story of the Gray African Parrot' (1859), a book for children, and 'Captain Brand of the Centipede' (1860).

WISE, Isaac Mayer, American rabbi and educator: b. Steingrub, Bohemia, 29 March 1819; d. Cincinnati, Ohio, 26 March 1900. He studied at Prague and Vienna, became rabbi at Radnitz, and, desirous of a broader field, emigrated to New York in 1846. He was elected rabbi of a synagogue at Albany, N. Y., but the ritual changes that he favored led to a division in the congregation, and a new temple was organized by his friends. In 1854 he was elected rabbi of the Congregation B'nai Teshurun, of Cincinnati, Ohio. In the same year he wrote a 'History of the Israelitish Nation' and began to publish *The Israelite*, followed in 1855 by *Die Deborah*. Throughout his long years of activity he sought in pulpit, press and on platform to advance the cause of progressive Judaism and became its practical and popular leader, to whose efforts were due the Union of American Hebrew Congregations, the Hebrew Union College and the Central Rabbinical Conference. In the formative period between 1856 and 1873 Rabbi Wise was enabled by means of his publications to reach the Jews of the United States, even in the remote places, without interruption, bringing not only the news, foreign as well as domestic, but industriously making propaganda for a union of congregations for the purpose of establishing a seminary to educate and train the rabbis who, in turn, were to preach the liberalization of Judaism and demonstrate that the ancient faith could be adopted to changed conditions without the sacrifice of even the least of its tenets. Wise was active in so many directions, and was so great a power in the history of Judaism in the United States, that it is necessary to treat under distinct headings the various achievements of his long and successful career. He was above all an organizer, and the numerous institutions that he called into being attest to the great influence he wielded during his life. In his later years Rabbi Wise was regarded as the most prominent Jew of his time in the United States. More than any of his contemporaries, it may be said of him that he left the impress of his personality upon the development of Judaism in the United States. Among his published works are 'Essence of Judaism' (1860); 'Judaism, Its Doctrines and Duties' (1862); 'Prayer Book' and 'Hymnal' (1863), which were quickly followed by his 'Origin of Christianity,' 'The Cosmic God,' 'The History of the Hebrews,' 'Second Commonwealth,' 'A Defense of Judaism versus Proselytizing Christianity' and 'Pronaos to Holy Writ.' He was president of the Hebrew Union College from its foundation in 1875 until his death. In 1919 the centenary of his birth was celebrated with great *éclat* throughout the United States.

WISE, John, American colonial clergyman: b. Roxbury, Mass., August 1652; d. Ipswich, Mass., 1725. He was graduated from Harvard in 1673 and 10 years later was settled as minister of the Second Parish Church in Ipswich, in which position he continued until his death. For remonstrating against the violation of charter rights in levying a province tax without authority from the Assembly, he was fined and imprisoned by Governor Andros in 1687. In 1689 he brought a suit against Chief Justice Dudley for denying him the privileges of the habeas corpus act, and in 1690 was chaplain to the expedition to Quebec. He took a decided and successful stand against the attempts of Increase and Cotton Mather to place the Massachusetts churches under the authority of ecclesiastical councils, putting forth two essays on the subject, 'The Churches' Quarrel Espoused' (1710) and 'A Vindication of the Government of New England Churches' (1717). A large edition of both essays was published in 1772 and a fourth edition with historical memoir by J. S. Clark (1860). In the memoir it is stated that several striking passages in the Declaration of Independence are nearly literal transcripts from the 'Vindication.' Consult Tyler, 'History of American Literature' (Vol. II, 1878).

WISE, John Sergeant, American lawyer, son of Henry Alexander Wise (q.v.): b. Rio de Janeiro, Brazil, 27 Dec. 1846; d. 12 May 1913. He studied at the Virginia Military Institute at Lexington, which he left in 1864 to join the Confederate army, was graduated from the law department of the University of Virginia in 1867 and began to practise his profession in Richmond. In 1881 he was elected to Congress from Virginia. He was defeated for governor of his State in 1885. He published 'Diomed' (1898); 'The End of an Era' (1899); 'The Lion's Skin' (1905); 'A Treatise on American Citizenship' (1906).

WISE, Peter Manuel, American alienist: b. Clarence, Erie County, N. Y., 7 March 1851;

d. 22 Sept. 1907. He was graduated at the medical department of the University of Buffalo in 1872; was president of the New York State Commission in Lunacy 1896–1901; and was professor of psychiatry at the University of Vermont 1891–95. He published 'Text-Book for Training Schools' (1896) and monographs on 'Asylums of Great Britain' (1882); 'Sexual Perversion' (1883), etc.

WISE, Stephen Samuel, American Jewish rabbi: b. Budapest, Hungary, 17 March 1872. He studied at the College of the City of New York in 1887–91, was graduated at Columbia University in 1892, and received the degree of Ph.D. there in 1900. He was pastor of the Madison Avenue Synagogue, New York, in 1892–1900; of Beth Israel, Portland, Ore., in 1900–06; and in 1907 he founded the Free Synagogue, New York, of which he has since been pastor. He is noted for his liberal views, his eloquence and for his social welfare work. He is an editorial contributor to the *Survey*, and his sermons at Beth Israel and at the Free Synagogue have been published monthly. He is also author of 'The Ethics of Solomon Ibn Gabirol' (1901); 'How to Face Life' (1917), etc.

WISE MEN OF THE EAST, The, the three Magi, who, according to the Gospel of Matthew (ii, 1, 2), followed the guiding star to Bethlehem in order to render homage to the new born King of the Jews. A legend, which can be traced back to the 2d century, calls them kings and later times distinguished them as Melchior, Gaspar and Balthasar. They are honored at the feast of the Epiphany and in art the youngest is portrayed as a Moor. In astral theology they were represented by Orion's three stars. Their bones are said to have been placed in the cathedral of Cologne and hence they are often referred to as the Three Kings of Cologne.

WISEMAN, wiz'man, Nicholas Patrick Stephen, English Roman Catholic prelate: b. Seville, Spain, 3 Aug. 1802; d. London, 15 Feb. 1865. He was of Irish parentage, was brought to Waterford, Ireland, at his father's death in 1805 and was educated at the Roman Catholic College, Ushaw, near Durham, and the English College at Rome. He took orders in 1825, became professor of Oriental languages in the Roman University in 1827 and in 1828 rector of the English College. He returned to England in 1835 and there delivered in 1836 at Saint Mary Moorfields, London, a series of lectures on 'The Principal Doctrines and Practices of the Catholic Church,' which attracted much attention. He was consecrated titular bishop of Melipotamos in 1840 and was made archbishop of Westminster and cardinal in 1850. This ecclesiastical appointment caused great excitement among English ultra-Protestants, who termed it a "papal aggression" and resulted in the "Ecclesiastical Titles Act" prohibiting the assumption of local ecclesiastical titles by Roman Catholics, which was not repealed until 1872. In the midst of the excitement Wiseman put forth a temperate address explaining the constitutional rights of Roman Catholics, entitled 'An Appeal to the Reason and Good Feeling of the People on the Subject of the Catholic Hierarchy' (1850), which was very instrumental in bringing about a better state of feeling. In 1836 he established with O'Connell the *Dublin Review* and was a regular contributor to it. He was the author of 'Lectures on the Connection between Science and Revealed Religion' (1836); 'Letters on Catholic Unity' (1842); 'Papal Supremacy' (1850); 'Fabiola' (1854); 'The Four Last Popes' (1858), etc. Consult Fitzgerald, 'Fifty Years of Catholic Progress' (London 1900); Houghton, 'Monographs' (1875); Thureau-Dangin, Paul, 'English Catholic Revival in the Nineteenth Century' (Eng. trans. by W. Wilberforce, rev. ed., 2 vols., New York 1916); Ward, 'Life and Times of Cardinal Wiseman' (1897; new ed., New York 1900); id., 'Ten Personal Studies' (London 1908); White, G., 'Memoir' (1865).

WISHAM. See WUSHKUM.

WISHART, wish'art, **George,** Scottish preacher and agitator: b. Pitarrow, Forfarshire, about 1513; d. Saint Andrew's (burnt), 1 March 1546. Leaving Scotland in 1538 to avoid persecution, he became in 1543 a tutor in Christ Church College, Cambridge, where he led, according to the testimony of one of his pupils, a life of singular abstemiousness, charity and purity. In July 1543 he returned to Scotland with the commissioners sent to negotiate a marriage treaty between Prince Edward and the infant queen of Scots. Under their protection he preached at Montrose, Dundee and other Scottish towns, and his preaching led the people to destroy some convents and Roman Catholic churches. Arrested at Ormiston by the Earl of Bothwell, he was delivered to Cardinal Beaton, who sentenced him to be burned at Saint Andrew's. Consult Foxe, 'Acts and Monuments'; Knox, J., 'History of the Reformation' (in 'Works,' ed. by D. Laing, Edinburgh 1846–64); Rogers, 'Life of George Wishart, the Scottish Martyr' (ib. 1876); 'Dictionary of National Biography' (Vol. LXII).

WISHART, or WISEHEART, George, Scottish bishop: b. Yester, East Lothian, 1609; d. Edinburgh, 1671. He is said to have been educated at the University of Edinburgh, and having entered the Episcopal Church, received a charge at Saint Andrew's. In 1639, having refused to take the covenant, he was deposed from the ministry, and during the supremacy of the Presbyterian party was several times imprisoned. He subsequently became chaplain to Montrose, and after that leader's death to Elizabeth, electress palatine and titular queen of Bohemia. He accompanied her to England, and on the Restoration was made rector of Newcastle, and in 1662 was consecrated bishop of Edinburgh. He is chiefly known by his 'History of the Wars of Montrose' (1647), written in elegant Latin. When Montrose (q.v.) was executed in 1650 a copy of this work was hung in derision about his neck. Several English translations of Wishart's work have appeared, the latest in 1819.

WISHOSKAN, a linguistic stock of North American Indians, comprising the Patawat Weeyot or Wiyot and Wishosk tribes, occupying the coast of California from a little below the mouth of Eel River to a short distance north of Mad River, including particularly the country about Humboldt Bay. They also extended up the streams named into the mountain passes. Of these tribes little is known, as they

are classed with the "Diggers" on account of their habit of living largely on roots. Their number is small, being at present less than 200.

WISHRAM. See Wishkum.

WISMAR, vis'mär, Mecklenburg-Schwerin, the second seaport of the province, situated on the Baltic, at the head of a bay of the same name, 20 miles north of Schwerin. It has an excellent harbor, carries on an active over-sea trade and has varied manufactures. Of the mediæval walls only four gates remain; but the numerous quaint old houses are a feature of the place, and several of the brick churches as well as the Fürstenhof, once a ducal residence, date from the 14th and 15th centuries. It was a Hanse town in the 13th century, passed to Sweden in 1649, was taken by the Danes in 1675, and by the Danes, Prussians and Hanoverians in 1712, when its strong fortifications were destroyed, and in 1803 was pawned to Mecklenburg-Schwerin, which secured it finally in 1828. Pop. 24,376.

WISSLER, Clark, American anthropologist: b. Wayne County, Ind., 18 Sept. 1870. He was graduated at Indiana University in 1897 and received the degree of Ph.D. at Columbia University in 1897. He was assistant and later lecturer in anthropology at Columbia in 1903–09; he was also assistant in ethnology at the American Museum of Natural History, New York, in 1903–06, and since 1906 has been curator there. His published works include 'The Correlation of Mental and Physical Tests' (1901); 'North American Indians of the Plains' (1912); 'Ethnology of the Blackfoot Indians' (1912); 'The American Indian' (1917).

WISSMANN, vis'mān, **Hermann von,** German African explorer: b. Frankfort-on-the-Oder, 4 Sept. 1853; d. 15 July 1905. He entered the German army, reaching the rank of lieutenant in 1874, and crossed the African continent in the employ of the German African Society (1880–82). He commanded an expedition sent out by Leopold II in 1884–85, and as imperial German commissioner in 1889–90 he suppressed the Arab revolt under Bushiri, but failed in attempting to take two steamers to Lake Victoria via Nyassa and Tanganyika lakes in 1892. He was governor of German East Africa in 1895–96, and president of the Berlin Geographical Society in 1897. He published 'In the Interior of Africa' (3d ed., 1891); 'Under the German Flag across Africa' (1880–83); 'My Second Crossing of Equatorial Africa' (1891); 'Africa: Descriptions and Advice' (1895), etc. Consult Ruhle, 'Hermann von Wissmann' (Münster 1892).

WISTAR, Caspar, American physician: b. Philadelphia, Pa., 13 Sept. 1761; d. there, 22 Jan 1818. He attended the medical department of the University of Pennsylvania in 1782, subsequently graduated in medicine at the University of Edinburgh (1786), returning to the United States in 1787. He was professor of chemistry and the institutes of medicine at the College of Philadelphia 1789–92. In the latter year that institution was united with the medical department of the University of Pennsylvania, and he was there adjunct professor of anatomy, midwifery and surgery 1792–1808; then becoming professor of anatomy and holding that chair until his death. He was the first to show that the posterior portion of the ethmoid bone was attached to the triangular bones. He opened his house once a week for meetings of students, travelers, scientists and citizens, and these symposiums continued long after his death, and were known as the Wistar parties. Wistar became a member of the American Philosophical Society in 1787, and succeeded Thomas Jefferson as its president in 1815. The Wistar Institute of Anatomy and Biology at the University of Pennsylvania was named in Wistar's honor, as was also the climbing shrub, popularly known as the "wistaria vine." He wrote 'A System of Anatomy for the Use of Students of Medicine' (1811–14).

WISTAR, Isaac Jones, American penologist: b. Philadelphia, Pa., 14 Nov. 1827; d. Claymont, Del., 18 Sept. 1905. He was educated at Haverford College, Pa., and served in the Civil War as brigadier-general of volunteers, United States army, 1862–65. He was president of the Academy of Natural Sciences of Philadelphia 1892–96, has been inspector of the Eastern Penitentiary of Pennsylvania, was president of the State Board of Charities of Pennsylvania and founded the Wistar Institute of Anatomy and Biology, named in honor of Caspar Wistar (q.v.).

WISTARIA, a genus of leguminous climbers, named in honor of Caspar Wistar, an American anatomist (1761–1818), which contains several species, natives of China, Japan and North America. They are high-climbing, hardy shrubs, and have odd pinnate leaves, with entire leaflets and large, terminal, pendulous racemes of papilionaceous flowers. These have large standards and wings freed from the keel, which is incurved and obtuse, and are usually purple or white. The fruits are coriaceous legumes, opening readily. Nearly all of the wistarias are cultivated for covering walls, verandas, trellises, etc. The Chinese wistaria (*W. chinensis*), which was introduced into England about 1816, is perhaps the best. It has profuse dense clusters of pea-shaped flowers, which are about a foot long and bloom in May before the leaves appear and occasionally again in autumn. When grown over a trellis, the blossoms depend in great masses of blue. This vine is a rampant grower, and the flowering wood may be known by its short, jointed, antler-like growth and absence of climbing spines.

Wistaria is a favorite plant of the Japanese, who have a variety (*W. chinensis multijuga*) with racemes a yard long, loosely flowered, and with small blossoms, which are fragrant, however. This plant they train about their houses and over trellises in the greatest profusion. The American wistaria (*W. frutescens*) or kidney-bean tree, is not so vigorous as the Chinese species and has slightly pubescent racemes, only about six inches long. It is found, when wild, climbing over trees at the edges of swamps from Virginia to Florida, and improves with cultivation.

WISTER, Annis Lee Furness, American translator: b. Philadelphia, Pa., 9 Oct 1830; d Philadelphia, Pa., 15 Nov. 1908. She was married to Dr Caspar Wister (d. 1888) in 1854. She made many translations of note, among them F. Marlitt's 'The Old Mamselle's Secret' (1868); 'Gold Else' (1868); 'The Countess

Gisela' (1869); 'The Little Moorland Princess' (1873); and 'The Second Wife' (1874); Wilhelmine von Hillern's 'Only a Girl' (1870); Hackländer's 'Enchanting and Enchanted' (1871); Volkhausen's 'Why Did He Not Die' (1871); Von Auer's 'It Is the Fashion' (1872); and Fanny Lewald's 'Hulda; or, The Deliverer' (1874). Her translations were issued in a uniform edition of 30 volumes in 1888. With F. H. Hedge (q.v.) she published 'Metrical Translations and Poems' (1888).

WISTER, Owen, American novelist, grandson of Frances Anne Kemble (q.v.): b. Philadelphia, 14 July 1860. He was graduated from Harvard in 1882, studied law and was admitted to the Philadelphia bar in 1889, but from 1891 has devoted his attention to literature. He has been especially successful in his delineation of Western life and character and has published 'The Dragon of Wantley: His Tail' (1892); 'Red Men and White' (1896); 'Lin McLean' (1898); 'The Jimmy John Boss and Other Stories' (1900); 'U. S. Grant, a Biography' (1900); 'The Virginian,' which has been widely popular and has been successfully dramatized (1902); 'Oliver Wendell Holmes' (in 'American Men of Letters' series, 1902); 'Benjamin Franklin' (in 'English Men of Letters' series, 1904); 'Lady Baltimore' (1906); 'Mother' (1907); 'Members of the Family' (1911); 'The Pentecost of Calamity' (1915).

WITCH, or WYCH, ELM, the common broad-leaved elm (*Ulmus glabra*) of England and Scotland, which does not grow to so large dimensions as the field elm; nevertheless at Selborne, Gilbert White measured a witch elm which, seven feet from the ground, was eight feet in diameter. It is a tree of picturesque habit, and, unless grown in crowded masses, rarely produces a straight trunk. It has a wide, spreading head, often slanted to one side, and the branches begin near the base. These drooping branches lash neighboring trees unmercifully, and if they chance to rest on the ground readily strike root. The tree is easily increased by layers or by the abundant seeds. The timber of the witch elm is more durable than that of other English elms, but has their fine-grained, tough and elastic qualities. It is very flexible when steamed, and is utilized for bent-wood work, frames in boat-building and bows; in olden times, if the branches were forked, they served as divining-rods, perhaps because of the likeness of the broad, ovate leaves to those of the hazel, which is one of the so-called lightning plants. These plants are sacred to Thor, are considered to be an actual embodiment of lightning, and their forked branches (having, according to mythology, a resemblance to a lightning flash) are used as talismans to point out the hidden stores of gold or subterranean water.

WITCH-HAZEL, a tall, sometimes arborescent shrub (*Hamamelis virginiana*) of eastern American woodlands. It has a characteristic horizontal, straggling growth; as Thoreau says: "Its spray, so jointed and angular, is not to be mistaken for any other." Witch-hazel is one of the most difficult shrubs to eradicate from a clearing, as it has many diverging stems, so crooked and springy as to render axe-work unsuccessful. The bark is pale-gray; the leaves, somewhat resembling the ovate foliage of the hazel-nut, are more or less oblique and undulate-edged, not at all handsome, but turning to a beautiful clear yellow in autumn. No sooner have they fallen off, with the rest of the forest foliage, in October or November, than the witch-hazels reclothe themselves with a luminous vesture of filmy, featherly yellow, which turns out to be the long-delayed blossoms — whether the earliest or the latest flowers of the year botanists cannot decide. Individually, they are not conspicuous, having only four narrow, strap-shaped, golden petals, but are so tufted on the twigs as to gild the bushes. Meanwhile the fruits, little blunt, horned woody capsules that have been slowly ripening since the previous fall, begin to gape, and by elastic fissuring and incurving their walls, shoot their stony-hard, bullet-shaped, polished seeds far and wide. Twigs of this witch-hazel, so unorthodox in its season of blooming, and remotely resembling the hazel-nut in foliage, were chosen as material for the forked divining-rods, which, twisting in the hand of the treasure-seeker, or well-digger, pointed downward and disclosed the site of subterranean water or gold. A much more practical use for witch-hazel has been found nowadays. An infusion of the leaves of witch-hazel in alcohol furnishes the familiar slightly astringent and tonic lotion for external inflammations known as "witch-hazel" or "hamamelis." Branches of witch-hazel thrown into the fire exhale the characteristic, peculiar odor of the lotion. Both the foliage and bark, moreover, contain much tannin. The witch-elm (q.v.) of England is also called witch-hazel.

WITCH HILL, the name of a hill in Salem, Mass., so called because of the executions of witches which took place there in 1692. It is also known as Gallows Hill.

WITCHCRAFT, supernatural power which persons were formerly supposed to obtain by entering into a compact with the devil. The compact was sometimes express, whether oral or written, when the witch abjured God and Christ, and dedicated herself wholly to the evil one; or only implied, when she actually engaged in his service, practised infernal arts, and renounced the Sacraments of the Church. The express compact was supposed to be solemnly confirmed at a general meeting, at which the devil presided, and sometimes privately made by the witch signing the articles of agreement with her own blood, or by the devil writing her name in his "black book." The contract was sometimes of indefinite duration, at other times for a certain number of years. The witch was bound to be obedient to the devil in everything, while the other party to the pact delivered to the witch an imp, or familiar spirit, to be ready at call and to do whatever was directed. He further engaged that they should want for nothing, and be able to assume whatever shape they pleased to visit and torment their enemies and accomplish their infernal ends. The belief in witchcraft appears to have existed in various forms among ancient nations, including the Hebrews; it prevails to-day among savage and semi-savage races, and is not extinct in civilized countries. It was always condemned by the Church, and in the 14th century the popes believed that they recog-

mized in sorcery a prevalent and dangerous evil, and began to issue bulls against it. In the 15th century the Inquisition took charge of the work of exterminating witches, and the close of that century, and the beginning of the 16th, witnessed thousands of executions in Germany, Italy and other countries. France was slow to permit any general persecution of witches, and it was not until about the time of the break with Rome that the first formal enactment, of 1541, declared witchcraft to be a felony in England. From that time on, for more than a century, the burning of witches was kept up in England and Scotland, the statute of 1563 being the first regular enactment against the supposed crime in the latter country.

The Reformation was attended by, or rather coincident with, an increased intensity of the witchcraft superstition, and its resulting horrors. Theologians of all creeds were equally believers in the reality of compacts with the devil, and regarded the persons who entered into such compacts as unfit to live. It is probable that the religious fervor aroused by controversy over disputed dogmas may have served to bring more vividly to the minds of clergy and laity alike their assumed obligation to obey the Scriptural injunction against witchcraft, and that, in this way, the Reformation may have promoted this form of persecution. Besides, the tribunals actively engaged in crushing out disbelief in the accepted creeds of their respective states could readily devote any surplus energy and zeal to what seemed to them the related crime of witchcraft. From one end of Europe to the other executions of witches were of daily occurrence, and it is estimated that, from the time of the promulgation of the bull of Pope Innocent VIII against sorcery, in 1484, until 1782, when the last judicial victim, a servant girl at Glarus, in German Switzerland, was executed, 300,000 women perished on this often imaginary charge. Some of the victims were probably poisoners, but very many of them were undoubtedly innocent of any wrong-doing whatever. Children of tender years were sometimes among the condemned.

Spanish America witnessed many executions on the charge of witchcraft, and it is stated on credible authority that as late as 20 Aug. 1877 five alleged witches were burned alive at San Jacobo, Mexico. This appears to have been more in the nature of a lynching than of an execution of a sentence of a competent court.

In England and Scotland, as already stated, the 17th century witnessed hideous scenes of witch-torture and extermination. The last victims in England were Mrs. Hickes and her daughter, nine years of age, executed in 1716, and the last in Scotland suffered in 1722. Prosecution for witchcraft was abolished both in England and in Scotland by George II (1736), which made all persons pretending to use the name punishable by imprisonment. By a subsequent act passed in the reign of George IV. they were made punishable as rogues and vagabonds.

All the American colonies had laws against witchcraft similar to those in England at the time, and from the first there were occasional trials and executions on that charge. The great Salem witchcraft delusion, with its attendant tragedies, occurred near the close of the 17th century and was largely due to excitement caused by the teachings and writings of Cotton Mather, the noted Puritan divine, who was a strong believer in the superstition. The Salem witch frenzy broke out in the family of one Samuel Parris, a minister, but for whose instigation the delusion, with its accompanying sacrifice of innocent lives, could not have obtained the headway it did. A company of girls suddenly began to act mysteriously, bark like dogs, and scream at something unseen. An old Indian servant was accused of bewitching them. The excitement spread and impeachments multiplied. A special court was formed to try the accused, and as a result the jails rapidly filled, and many were condemned to death. It was unsafe to express a doubt of a prisoner's guilt. Fifty-five persons suffered torture, and 20 were executed before the delusion ended. Witches were supposed to be able, with the assistance of the devil, not only to foretell events, but to produce mice and vermin, to deprive men and animals, by touching them or merely breathing on them, of their natural powers, and to afflict them with diseases, to raise storms, etc., to change themselves into cats and other beasts, etc. General assemblies of witches, called 'Witches' Sabbaths,' were held yearly, or oftener, at which they appeared entirely naked, and besmeared with an ointment made from the bodies of unbaptized infants. To these meetings they were supposed to ride from great distances on broomsticks, pokers, goats, hogs, or dogs, the devil taking the chair under the form of a goat. Here they did homage to their master, and offered him sacrifices of young children, etc., and practised all sorts of license till cock-crowing. Neophytes were introduced to the devil at these meetings, and received his mark on their bodies, in token that they had sold their souls to him. As before remarked, the belief in witchcraft still prevails in many parts of the world, and in some countries where pretended sorcerers exert a powerful influence, lives are often sacrificed as a result of their practices and in order that they may continue their nefarious work.

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des Mittelalters' (Breslau 1858); Sharpe, C. K., 'Historical Account of the Belief in Witchcraft in Scotland' (London 1884); Scott, Sir Walter, 'Letters on Demonology and Witchcraft' (new ed., ib. 1884); Toy, C. H., 'Introduction to the History of Religions' (Boston 1913); Upham, 'History of the Salem Delusion' (new ed., Boston 1867).

WITENAGEMOT, wit'ē-nā-gē-mōt', or **WITENAGEMOTE**, originally an assemblage of all the freemen of a tribe or state, among the Teutonic conquerors of southern Britain, but which, in the course of events, and without any special law, resolved itself into an assembly of the princes, aldermen, thanes, large landowners and leading ecclesiastics. The witenagemot met once a year or oftener, and had great power, electing a king in the event of disputed succession, approving the regular succession, if there was no dispute, passing upon the trial and punishment of high offenders, enacting laws, and acting as a grand inquest into public affairs. It passed out of existence with the Norman Conquest, and the subsequent Parliament was a separate growth, and not a continuation of the Witenagemot. Consult Chadwick, H. M., 'Studies on Anglo-Saxon Institutions' (Cambridge 1905); Freeman, E. A., 'History of the Norman Conquest' (5 vols., Oxford 1872–79).

WITHER, with'ėr, or **WITHERS, George**, English poet and pamphleteer: b. Bentworth, near Alton, Hampshire, 11 June 1588; d. London, 2 May 1667. He studied at Magdalen College, Oxford (1604–06), but did not obtain a degree, and a few years later he went to London to study law. He devoted much attention to literature, and proved his skill in satiric verse by being thrown into the Marshalsea for his 'Abuses Stript and Whipt' (1613). While there imprisoned he wrote busily, and is said to have composed there several of his best poems, among them 'The Shepherd's Hunting' (1615), a continuation of 'The Shepherd's Pipe' (1614) of William Browne (q.v.). After his release he entered Lincoln's Inn, in 1615. About this same time he wrote the love elegy 'Fidelia.' In 1621 some official persons thought reflections against the state and leading politicians were to be detected in 'Wither's Motto, Nec Habeo, Nec Careo, Nec Curo' (1621), and again the author was ordered to the Marshalsea, though soon liberated. After 1622 he wrote nothing, save 'Hallelujah' (1641), a collection of religious verse, that in critical estimation attained the rank of earlier work. He became a Puritan, and wrote largely for the furtherance of the political and religious cause with which he was identified. At the revolution, he recruited (1642) a troop of horse for Parliament, and was made captain and the commander of Farnham Castle. When taken by Royalists and in danger of capital punishment, he was released through the interference of Sir John Denham (q.v.), who protested that "so long as Wither lived he (Denham) would not be accounted the worst poet in England." He was promoted major, made a commissioner for the sale of the king's goods, and (1655) became a clerk in the statute-office of the court of chancery. For his 'Vox Vulgi,' a poem dissuading from the restoration which remained in manuscript until printed by Macray in 'Anecdota Bodleiana' (1880), he was committed to Newgate in 1660 and imprisoned there until released in 1663 under bond for good behavior. 'Fragmenta Poetica' (1666; reprinted as 'Fragmenta Prophetica,' 1669) was his last work. For some time subsequent to his death he was considered a rimer of no merit, was omitted from collections of English poetry, and included in the 'Dunciad' as "wretched Withers." But Ellis praised him in 'Specimens of the Early English Poets' (1790), and others, including Sir S. E. Brydges by various reprints and Lamb by the essay 'The Poetical Works of George Wither' (Lamb's 'Works,' 1818, new ed., New York 1903) obtained for him suitable recognition. His reputation is based chiefly on his earlier work. The greater part of his writings was printed by the Spenser Society (20 vols., 1870–83). Consult besides the books already mentioned Ward's 'English Poets' (Vol. II, 1880); and Sidgwick, F. (ed.), 'The Poetry of George Wither' (London 1902).

WITHERITE, a mineral composed of barium carbonate mined extensively near Hexham, Northumberland, England. Usually found in massive condition though orthorhombic crystals do occur; hardness, 3 to 3.75; specific gravity, 4.29 to 4.35; lustre, vitreous; color, white, often yellowish or grayish; streak, white. Used in the manufacture of baryta for sugar refining, in plate-glass making, and in the adulteration of white lead and zinc white.

WITHERSPOON, Herbert, American opera singer: b. Buffalo, N. Y., 21 July 1873. He was graduated at Yale University in 1895, meantime studying harmony and the theory of music under Horatio Parker and Macdowell, and singing under M. Treumann and W. J. Hall of New York. He made his début at New Haven in 1895, and in 1896 he was basso with the New York Symphony Orchestra. He afterward studied singing in London and Paris, and acting in Vienna, and in 1899 he made his operatic début at Boston with the Castle Square Opera Company. In 1908–16 he was first basso of the Metropolitan Opera House, New York, singing about 25 leading parts.

WITHERSPOON, John, American Presbyterian clergyman and college president; b. Yester, Haddingtonshire, Scotland, 5 Feb. 1723; d. near Princeton, N. J., 15 Nov. 1794. He was graduated from the University of Edinburgh in 1742, was licensed to preach the next year and was parish minister of Beith, 1745–57. He led a body of militia to the aid of the Pretender at Glasgow in 1745, and was captured at the battle of Falkirk, but was soon released. He was pastor at Paisley, 1757–68, and then accepted the presidency of the College of New Jersey (now Princeton College) in 1768. He was a delegate for six years from New Jersey to the Continental Congress; and a signer of the Declaration of Independence. He greatly increased the efficiency of the college and was a noteworthy figure in the political as well as the educational affairs of his time. He wrote 'Ecclesiastical Characteristics' (1753); 'Nature and Effects of the Stage' (1757); 'Essays on Important Subjects' (1764); 'Considerations

on the Nature and Extent of the Legislative Authority of the British Parliament' (1774), etc. His collected works appeared in nine volumes in 1804. Consult Sanderson, J., 'Biography of the Signers of the Declaration of Independence' (Philadelphia 1865); Tyler, M. C., 'Literary History of the American Revolution' (Vol. II, 1897); Woods, D. W., 'John Witherspoon' (New York 1906).

WITHERSPOON, John A., American physician and educator: b. Columbia, Tenn., 13 Sept. 1864. He was graduated M.D. at the University of Pennsylvania in 1887, and engaged in practice at Nashville, Tenn. He was connected with the faculty of Vanderbilt University from 1889, and is now professor of medicine and clinical medicine there. He was also connected with the medical faculty at the University of Tennessee in 1889–94. He was president of the American National Medical Association in 1913–14.

WITHINGTON, with'ing-tŏn, England, a manufacturing town in Lancashire, three miles south of the centre of Manchester, in the parliamentary borough in which it is partly included. It contains modern churches and chapels, Lancashire Independent College, a public hall and library, and numerous residential villas. Pop. 41,578.

WITMER, Lightner, American psychologist and educator: b. Philadelphia, Pa., 28 June 1867. He was graduated at the University of Pennsylvania in 1888 and received the degree of Ph.D. at the University of Leipzig in 1892. He was connected with the faculty at the University of Pennsylvania from 1892, and since 1909 he has been director of the psychological laboratory and clinic there, which he organized as a department of the university. He lectured on psychology at Bryn Mawr College in 1896–98; and gave courses in psychology at Lehigh University in 1903–05. He has also been psychologist at the Pennsylvania Training School for Feeble-Minded Children at Elwyn, Pa., since 1896. In 1907 he founded the *Psychological Clinic*, of which he is the editor. He wrote 'Analytical Psychology' (1902); 'The Nearing Case' (1915); and edited 'Experimental Studies in Psychology'; 'The Special Class for Backward Children'; and is a frequent contributor to technical and educational reviews on topics in experimental and clinical psychology.

WITNESS, *in law,* a competent person called to give testimony, as in a court of justice, regarding facts in issue. Formerly the jurors acted as witnesses, and it was not until about the 15th century that the custom was discontinued. A witness, either in a civil or a criminal case, may be compelled to attend court when required by law. A witness is commonly summoned by a subpœna, and if he does not attend when called without giving sufficient excuse, he is liable for damages to the party who subpœnaed him. In addition, he may be punished by fine or imprisonment. In some jurisdictions, a prisoner is not allowed to be a witness in his own behalf, but the rule is not general.

Formerly many objections against the competency of witnesses were allowed, but many of these have been removed by legislation. A prisoner cannot be called as a witness for the prosecution to give evidence against himself. Usually a wife is not a competent witness against her husband, or a husband against his wife. A witness is exempt from civil arrest while in attendance at court, but not from arrest on a criminal charge. A witness usually testifies orally in open court, but sometimes his testimony is taken in writing before a commissioner or other legal official.

WITTE, vit'tĕ, **Emanuel,** Dutch painter: b. Alkmaar, Holland, 1607; d. Amsterdam, 1692. He was a pupil of Van Alst, lived at Delft in 1642 to 1649 and in 1650 went to Amsterdam. His earlier paintings were mostly historical or portraits, but later he devoted some attention to interior decorations with which he was very successful. His works are found at the museums of Amsterdam, Rotterdam, Brussels, Berlin, Hamburg and Weimar, also in the National Gallery at London, and in some private English galleries.

WITTE, Pietro de, Dutch painter: b. Bruges, 1548; d. Munich, 1628. His general choice of subjects was confined to history, but it is not known under whom he studied in his native country before going to Italy, where he became an intimate friend of Giorgio Vasari, under whom he appears to have formed his style. When Vasari was employed to decorate the Vatican with frescoes De Witte became his favorite assistant, and grew almost completely Italianized in his artistic ideals. He painted equally well in fresco and oils, and was invited to Florence by the Grand Duke of Tuscany, and there executed some important works. His versatility is shown by the fact that when Maximilian, the Elector of Bavaria, required the services of a designer of tapestry De Witte was commissioned to furnish the necessary cartoons. He was one of the Dutch painters of the Renaissance period who gave himself up entirely to the influence of foreign schools and spent but a short part of his life in the Netherlands. His principal works have been engraved by Jan Sadeler and other famous engravers of his day.

WITTE, Sergei Yulievitch, COUNT, Russian statesman: b. Tiflis, 29 July 1849; d. 1915. He was graduated from the New Russian University, Odessa; devoted some time to journalism, and in 1877 entered the governmental railway service. He had charge of transporting troops on the Odessa Railway during the Russo-Turkish War, in 1879 was given a position on the Southwestern Railway, in 1886 became general manager of that road, and two years later chief of the Imperial Railway Department. In 1892 he was made Minister of Finance, and in this capacity he made several commercial treaties with Germany, aided the development of manufacturing industries, made the sale of alcohol a government monopoly and established the gold standard. His policy aroused the opposition of wealthy bankers, and of all conservatives, and in 1903 he was removed from the office of Minister of Finance, but was appointed president of the committee of ministers. In 1905 he, with Baron Rosen, satisfactorily arranged the Treaty of Portsmouth (q.v.), was created a count, on 30 October was appointed Premier, Russia's first Prime Minister, but resigned 2 May 1906 and was

appointed a member of the council. (See RUSSIA — HISTORY). He wrote 'Principles of Railway Tariffs' (1883); 'Friedrich Liss, the Economist' (1888).

WITTEKIND, vĭt'tĕ-kĭnd, or **WIDUKIND,** Saxon leader in the struggle with Charlemagne: d. about 807. He came of a noble Westphalian house, and first appears at the head of the Saxon expedition against the Westphalian fortress of Eresburg in 1774. Charlemagne's return from Lombardy drove him across the Weser, and instead of submitting to the emperor at the Diet of Paderborn in 777 like many other Saxon leaders, having renewed the revolt in 776, he fled to Jutland. He returned during Charlemagne's absence in Spain, laid waste the Rhineland and surprised and annihilated the Frankish army on the Süntelgebirge (782). The emperor retaliated by executing 4,500 Saxon prisoners, an action that aroused the entire Saxon race to arms. The battle of Detmold was indecisive (783), but that of Osnabrück forced Wittekind to enter on negotiations; the issue was that in 785 he accepted baptism in the imperial camp at Attigny, in Champagne. The emperor, it is said, made him duke of the Saxons and lord of Engern, and from the castle of Babilonie, near Lübeck, he exercised a benignant sway till he fell in battle with Gerold, the Swabian duke. Various princely houses, as those of Brunswick and Sardinia, claim Wittekind for the founder of their line. The Emperor Charles IV in 1377 placed a monument to him in the parish church at Enger, where he is supposed to have been buried, and in Menden, Westphalia, a monument was erected to him in 1812. Consult Dettmer, J., 'Der Sachsenführer Widukind nach Geschichte und Sage' Wurzburg 1879); Diekamp, 'Widukind der Sachsenführer, nach Geschichte und Sage' (Münster 1877); Mowbert, 'Charles the Great' (New York 1888).

WITTENBERG, wĭt'ĕn-bĕrg (Ger. *vĭt-tĕn-bĕrg*), town on the Elbe, 45 miles southeast of Magdeburg. It was the home of the Reformation, and here Luther, while a university professor, nailed his 95 theses to the door of the Schlosskirche. The university in which he was professor was united to Halle in 1817. The principal buildings are the Schlosskirche, in which both Luther and Melanchthon are buried; the Stadtkirche, where Luther and Melanchthon preached; the remains of the Augustinian monastery, with Luther's apartments; the houses of Melanchthon and Cranach; the townhall, the gymnasium, etc. There are public monuments to Luther and Melanchthon. Textiles, hosiery, leather, machinery, pottery, electrical apparatus, bricks, cement, essential oils, etc., are among the manufactures. Pop. 22,419.

WITTENBERG COLLEGE, located at Springfield, Ohio. It was founded in 1845 under the auspices of the Lutheran Church in Ohio. Its organization included a Preparatory School, a Collegiate Department, a Theological Seminary, a School of Oratory, a Conservatory of Music and a School of Art. There is also a Summer School, designed chiefly for teachers, giving courses in pedagogical methods. The Collegiate Department confers the single bachelor's degree of A.B. for a four years' course. Women are admitted to all departments. In 1919 the grounds, buildings and endowments were valued at $1,200,000; the library contained 30,000 volumes. The students numbered 1,120 and the faculty 40.

WITTHAUS, wĭt'hows, **Rudolph August,** American toxicologist: b. New York, 30 Aug. 1846; d. 23 Dec. 1915. He was graduated from Columbia in 1867 and from the Medical Department of the University of New York in 1875; was professor of toxicology and chemistry at Cornell University and held similar chairs in the universities of New York, Vermont and Buffalo. He became noted as an expert in poisons in connection with many murder cases, and has published 'Essentials of Chemistry' (1879); 'General Medical Chemistry' (1881); 'Manual of Chemistry' (1879; 6th ed., 1908); and 'Laboratory Guide in Urinalysis and Toxicology' (1886). He has edited 'Witthaus and Becker's Medical Jurisprudence' (4 vols., 1906–11), for which he prepared the introduction, and Vol. IV on 'Toxicology.'

WITWATERSRAND, vĭt-wä'tĕrs-rănd ("White Waters Range," colloquially "The Rand"), Transvaal, South Africa, a low range of hills extending 25 miles either side of Johannesburg, since 1886 famous as one of the richest gold-mining districts in the world. See TRANSVAAL, GOLD-MINING IN THE.

WIXOM, wĭk'sŏm, **Emma.** See NEVADA, EMMA.

WIYOT. See WISHOSKAN.

WOAD, wōd, a cruciferous herb (*Isatis tinctoria*), which has been used for centuries in the countries of temperate Europe, as a dye-plant, yielding an indigo-blue color. The woad has entire foliage, the stem leaves being sagittate, and has large coriaceous pods. Cæsar tells us that the ancient Britons stained their bodies with woad, so as to give themselves a more formidable appearance in battle; and from Pliny we learn that their women, before engaging in certain religious rites, also covered their nude bodies with the dye. The plant was formerly much cultivated in England for the sake of its dye, which was extracted from its crushed and fermented leaves, but the stronger and finer blue produced by the indigo-plant (q.v.) finally superseded it, although at first the latter produced but a crude dye. Those who cultivated woad opposed the introduction of indigo, and the opposition to it became so pronounced that in England and other European countries royal edicts were issued forbidding its importation. They were repealed by the middle of the 18th century. Woad is now mixed in the vats with indigo juice, but is of use chiefly as a convenient material to induce fermentation, although it is said also to improve the color itself.

WOBURN, wō'bĕrn, Mass., city in Middlesex County, on two lines of the Boston and Maine Railroad, five miles from tidewater and 10 miles northwest of Boston. It is well laid out and has many handsome residences. The chief manufactures are leather, chemicals, machinery, glue and foundry products. The waterworks are owned and operated by the city. There are several churches; a high school, established in 1852; public and parish elementary schools and a free public library which con-

tains about 50,000 volumes and a fine art collection. There are three banks. The Woburn Five Cent Savings Bank has deposits amounting to nearly $2,000,000. The government is administered under a charter of 1898 which provides for a mayor and a council of 15 members. Seven of the members of the council are elected by wards and eight at large. There is also a board of public works, the mayor is president ex officio. Woburn was settled in 1640 by seven families from Charlestown Church, Mass. It was first called Charlestown Village. In 1642 the town was incorporated, and in 1889 chartered as a city. Benjamin Thompson (Count Rumford) was born here in 1753. Pop. 16,410. Consult Hurd, 'History of Middlesex County' (Philadelphia 1890) and Sewall, 'History of Woburn' (Boston 1868).

WODAN, WODEN, or **WUOTAN,** Teutonic god of the winds and storms, who rose ultimately to the dignity of the greatest of all the gods. See ODIN.

WOFFINGTON, wŏf'ĭng-tŏn, **Margaret** or **Peg,** British actress: b. Dublin, Ireland, 18 Oct. 1720; d. Teddington, 28 March 1760. She first appeared on the stage at 12 as Polly Peacham, with several other children, in 'The Beggar's Opera,' but her first appearance in a mature part was as Ophelia in Dublin in 1737. From 17 to 20 she played on the Dublin stage all manner of parts, from Ophelia to Sir Harry Wildair, and on 6 Nov. 1740 made her first appearance at Covent Garden as Sylvia in the 'Recruiting Officer.' She soon became a great success, the exquisite art of her male characters being especially remarkable. She kept the affection of the public till the tragic close of her career. On 3 May 1757 she broke down in playing Rosalind, and left the stage forever. Her character appears to advantage in Reade's novel 'Peg Woffington,' and his play 'Masks and Faces.' Consult Dobson, Austin, Introduction to Charles Reade's 'Peg Woffington' (London 1899); Molloy, 'Life and Adventures of Peg Woffington' (New York 1899); Daly, Augustin, 'Woffington: a Tribute to the Actress and the Woman' (New York 1888).

WOFFORD COLLEGE, located at Spartanburg, S. C. It was founded in 1851 under the control of the South Carolina Conference of the Methodist Episcopal Church, South, in accordance with the will of Benjamin Wofford, a minister of that Church, who left a legacy of $100,000 to the conference for establishing a college. It was opened to students in 1854, and the sessions have never been entirely suspended, though during the Civil War the college suffered heavily, the endowment was rendered worthless, and full college work was not done. Since that time the college has been largely supported by the Church, and the endowment partially restored, amounting in 1918–19 to $200,000. Two preparatory schools have been established in connection with the college, the Wofford College Fitting School at Spartanburg, and the Carlisle Fitting Schol at Bamberg, S. C. The course in the former is three years; in the latter, four years. The Carlisle school is coeducational. The college studies are arranged in four groups, or courses, the classical, the language-scientific, the scientific and the Latin or Greek-modern language; each group includes a certain number of electives. The degree of A.B. is conferred for the completion of any of these courses. Instruction in methods of teaching and in school organization is included in the curriculum. Gymnasium work is required of all students. There are 24 loan funds and four scholarship funds. The students maintain three literary societies, membership in one of which is compulsory, and a Christian Association which has been in existence over 35 years, and exercises an important influence on student life. The college campus comprises 70 acres; the buildings include the main building, the John B. Cleveland Science Hall, Alumni Hall (a dormitory), residence cottages, the Wilbur E. Burnett gymnasium, Whiteford Smith Library Building and the fitting school. The library in 1919 contained 26,000 volumes; the students at Spartanburg numbered 480, of whom about 175 were in college.

WOHLGEMUTH, vōl'gĕ-moot, **Michael,** German painter: b. Nuremberg, 1434; d. there, 1519. He was an eminent member of the Franconia school of German painting whose most complete representative is Albert Durer. The latter was indeed his pupil in the large studio or workshop where many branches of art were carried on by the master and a host of pupils and assistants. The occupations of this artistic association comprised altarpieces, consisting of paintings, or wood carvings in high relief ablaze with color and gilt, such as abound in Spanish churches under the name of *retablos;* wood engraving, the blocks being cut from Wohlgemuth's designs, which were of supreme vigor and well adapted to the exigencies of printing from wood and easel paintings of portraits and history. Many paintings have been attributed to him which were evidently executed by the less skilful hands of pupils or assistants, but those whose authenticity is unquestionable are characterized by powerful drawing, rich and harmonious coloring and supreme delicacy of finish. His retable (1465), now in the Munich Gallery, is a remarkable masterpiece, and that which he furnished for the high altar of Saint Mary at Zwickau gained for the painter much applause and the then princely sum of about $3,558. Another work of the same kind is to be found in Nuremberg Museum, having been originally painted for the churches of the Austin Friars at Nuremberg; his last retable was executed for the church at Schwabach (1508). His fidelity and grace as a portrait painter are acknowledged by critics, who recognize in his realistic vigor and conscientious mastery of detail the best features of contemporaneous German painting. Two of his paintings, 'Pilate Washing His Hands Before the People' and a 'Descent from the Cross,' are in the Royal Institution Gallery at Liverpool, but few works of this master are to be found elsewhere out of Germany. Consult Dickinson, H., 'German Masters of Art' (New York 1914); Stadler, F. J., 'Michel Wolgemut und der Nürnberger Holzschnitt' (Strassburg 1913); Thode, 'Die Malerschule von Nürnberg' (Frankfort 1891).

WOJWODE, woi'wōd, an old Slavonic name for a general, afterward used as a title of civil rank and authority. The princes of Wallachia and Moldavia were called wojwode and this name was given in Poland to the

cal Society, and the original is among the manuscripts of the Connecticut Historical Society.

WOLCOTT, Roger, American lawyer and governor: b. Boston, 13 July 1847; d. there, 21 Dec. 1901. Graduated from Harvard University in 1870 and from the law-school of the university in 1874, he was admitted in the latter year to the bar, but subsequently practised little. In 1877–79 he was a member of the common council of Boston, and in 1882–85 of the Massachusetts House of Representatives, where he gained a considerable reputation by his oratory and his activity in constructive politics and the furtherance of good government. He was sent as a delegate to the State Republican Convention in 1885, in 1887–89 was again a member of the Boston common council, and in 1891 was chosen first president of the newly-organized Republican Club of Massachusetts, in which post he rendered valuable service to his party. This was recognized by his nomination as lieutenant-governor. He was elected in 1892, served by re-election until 1896, and upon the death of Gov. F. T. Greenhalge in the latter year became acting governor. In November 1896 he was elected governor by the largest plurality ever given in the State to a candidate for the office. In 1897 and 1898 he was re-elected. He declined the position as member of the Philippine Commission, and also the ambassadorship to Italy in 1899. Consult Lawrence, W., 'Roger Wolcott' (Boston 1902).

WOLF, Emma, American novelist: b. San Francisco, Cal., 15 June 1865. She was educated in the schools of her native city, and early developed a bent for authorship. She has published 'Other Things Being Equal' (1892); 'Prodigal in Love' (1894); 'Joy of Life' (1896); 'Heirs of Yesterday' (1900); 'Fulfillment' (1916).

WOLF, vŏlf, **Ferdinand,** Austrian romance scholar: b. Vienna, 8 Dec. 1796; d. there, 18 Feb. 1866. He studied philosophy and jurisprudence at Gratz; received a position in the Royal Library at Vienna in 1827 and took an active part in the foundation of the Academy of Sciences, of which he became secretary. Among his many publications, all characterized by research and critical acumen, are 'Collection of Modern Castilian Rhymes' (2 vols., 1837); 'Historical Studies of Spanish and Portuguese National Literature' (1859); 'History of Brazilian Literature' (1863), etc. With C. Hofmann he edited a collection of the oldest Spanish romances and contributed frequently to the Vienna 'Jahrbücher der Litteratur.'

WOLF, Friedrich August, German classical scholar: b. Haynrode, near Nordhausen, Prussia, 15 Feb. 1759; d. Marseilles, France, 8 Aug 1824. He was educated at the gymnasium of Nordhausen and the University of Göttingen, and in 1782 was appointed rector of the Bürgerschule at Osterode in the Harz. The next year he was called as professor of philosophy and paideutics to Halle, where he labored for many years with the highest enthusiasm for the cause of education. In 1795 appeared his 'Prolegomena Homerum' (3d and 4th eds., 1872 and 1875). In this he contended that the 'Iliad' and 'Odyssey' were not the work of one man, but of several Homeric rhapsodists (wand-bearing minstrels). The work in which he tried to maintain this statement created a profound sensation and has had the effect of permanently modifying the opinions of Homeric scholars as to the manner of the composition of the 'Iliad' and 'Odyssey.' (See HOMER). From a literary point of view his labor has been of immense service. The University of Halle was suppressed in 1807, in the storm of the French invasion, and Wolf then removed to Berlin, where he entered the Ministry of Public Instruction, but soon resigned that he might give himself to the work of academic teaching, which disappointment and ill-health compelled him to give up in 1824 when he went south on a voyage for the sake of his health, but did not long survive his arrival at Marseilles. Wolf's great work was the invention, or at least the bringing into prominence, of a new instrument of education, namely, philology, which he defined as no meagre study of the forms of language but "a knowledge of human nature as exhibited in antiquity." Locke and Rousseau had founded a school of educational theory which they considered to be more in accordance with common sense and modern needs than the classical culture of the Renaissance. Wolf revived the mental discipline and scientific aim implied in the prosecution of classical studies. Consult Arnoldt, 'Friedrich August Wolf in seinem Verhältnisse zum Schulwesen und zur Pädagogik' (Brunswick 1861–62); Pattison, Mark, 'Essays' (Oxford 1889); Wolf, 'Prolegomena ad Homerum' (Halle 1795); Hüller, 'Homerische Vorschule' (1836); Lachmann, 'Betrachtungen über Homers Ilias' (1865); Sandys, J. E., 'A History of Classical Scholarship' (Vol. III, Cambridge 1908); Volkmann, 'Geschichte und Kritik der Wolf'schen Prolegomena' (1874); also the Homeric writings of Gladstone, Blackie, Paley, Heyman and Geddes.

WOLF, wülf, **Henry,** American engraver: b. Eckwersheim, Alsace, 3 Aug. 1852; d. 18 March 1916. His artistic training was completed at Strassburg, and when he came to New York, in 1871, his ability soon made itself known. He exhibited at the Paris Salon in 1888 and 1895, winning a gold medal in the latter year; at the World's Columbian Exposition of 1893; the Paris expositions of 1889 and 1900; Saint Louis in 1904 and at the Panama-Pacific Exposition, San Francisco in 1915, winning a grand prize. His chief works are 'Engravings Illustrating American Artist Series' and 'Gilbert Stuart Series of Women and Men' in the *Century Magazine*.

WOLF, Hieronymus, German classical scholar: b. Göttingen, 13 Aug. 1516; d. 8 Oct. 1580. From 1557 until his death he was director of a school at Augsburg. He was one of the foremost Greek scholars of his century and is held in remembrance for his carefully annotated editions, with Latin translations, of Isocrates (1570) and Demosthenes, as well as for editions of Byzantine historians and many other classical labors.

WOLF, Hugo, Austrian composer: b. Windischgraz, Styria, 13 March 1860; d. Vienna, 22 Feb. 1903. He received his early instruction on the piano and violin from his father, who was in the leather trade, but was deeply interested in music. He studied at the Vienna Conservatory in 1875–77, but was then dismissed for his supposed implication in a practical joke, and from this time had only self-instruction.

For some years he gave piano lessons and with some slight assistance from his father gained a bare subsistence. In 1884–87 he was musical critic on the *Salonblatt*. He ardently championed the music of Wagner and as bitterly attacked that of Brahms, with the result that he made many enemies, and in 1887 after the publication of 12 of his songs he abandoned his work on the *Salonblatt* to devote himself entirely to composition. His production was irregular, his highly emotional temperament, already foreshadowing the insanity that was to overtake him, spurring him at times to incessant work and again he lapsed into utter inactivity, at which periods he was subject to profound depression. His work, despite his dark moods and mad haste in production, maintained a steady high level that kept a devoted circle of friends, mainly critics and singers, about him; but his irritability hindered his material success despite their efforts. His work was never financially successful and he lived in cheap lodgings until 1896 when his friends bought a house for him and installed him in it. He enjoyed it only a year before insanity overtook him and he was placed in an asylum. A temporary improvement caused his release some months later, but after attempting suicide by drowning he asked to be returned to the asylum, where he died four years later. His fame rests securely upon his songs, of which he wrote 266, and which give him rank as one of the greatest of song-writers. His success was due not alone to his mastery of the art of composition but to a broad knowledge and love of literature. Superbly original, gifted with rare poetic insight and a high dramatic sense, his music invariably expresses the meaning of the poem set to it, as fully as if words and music were evolved simultaneously from his own brain. He scorned the art which made the words of a song a mere vehicle to carry the music, but while faithfully interpreting the sense of the verse he developed a breadth of style and intense dramatic power that leave him unrivaled among song-writers. His work as a composer was practically at an end in 1891. His works include 'Mörike Lieder' (43 songs); 'Eichendorff Lieder' (20 songs); 'Goethe Lieder' (51 songs); 'Spanisches Liederspiel' (44 songs); 'Italienisches Liederbuch' (1st part 22 songs; 2d part 24 songs); he wrote also settings for 13 lyrics by different authors, several choral works and orchestral pieces, and the opera 'Der Corregidor,' which was successfully produced in 1895. Consult Decsey, E., 'Hugo Wolf' (4 vols., 1903–06); Von Hellmer, E., 'Hugo Wolf' (1912); Heckel, K., 'Hugo Wolf in seinem Verhältniss zu Richard Wagner' (Munich 1905); Batka and Werner, 'Hugo Wolfs musikalische Kritiken' (Leipgiz 1911); Newman, 'Hugo Wolf' (London 1907); Schmitz, E., 'Hugo Wolf' (Leipzig 1907).

WOLF, Rudolf, Swiss astronomer: b. Fallanden, near Zürich, 7 July 1816; d. Zürich, 6 Dec 1893. He was teacher of mathematics and physics in the realschule at Berne, 1839–55, and director of the observatory there in 1847. He was also professor of astronomy in the Berne University in 1853; professor of astronomy in the Polytechnikum and director of the observatory at Zürich in 1855 and later professor of mathematics and astronomy in the university there. He was famous for his investigations concerning the periodicity of sun spots and the accompanying magnetic variations, and wrote extensively on the history of science, especially astronomy. His 'Astronomical Miscellany' (1856–93) is a well-known series of papers, and his 'History of Astronomy' (1877) is a standard work of reference.

WOLF, wülf, **Simon,** American lawyer and communal worker: b. Hinzweiler, Bavaria, 28 Oct. 1836. He was graduated from the Ohio Law College, Cleveland, Ohio, in 1861, and served as recorder of deeds for the District of Columbia, 1869–78. He was judge of the Municipal Court for the District of Columbia, 1878–81, and in 1881–82 United States Minister to Egypt. While prominent in social and benevolent circles in Washington, he is identified with Jewish progress in America, was a founder of the B'nai B'rith Orphan Asylum at Atlanta, Ga., and for many years president of the Board of Delegates on Civil and Religious Rights of the Union of American Hebrew Congregations. In addition to various monographs, he has published 'The American Jew as Soldier, Patriot and Citizen' (1898); 'Biography of M. M. Noah' (1898); The Presidents I Have Known' (1917).

WOLF, a river in Wisconsin; rises in the northeastern part of the State, flows generally south, passes through Pewaugan Lake and enters the Fox River. Wolf River has been of great benefit in the development of the lumber industry in the northeastern part of the State. It is navigable for small steamers for about 150 miles.

WOLF, a typical wild species of the dog family (*Canidæ*). So closely related are wolves to the domestic and other true dogs (q.v.) that zoologists have been unable to find any satisfactory structural differences. As the distinctions are purely specific and largely founded upon the habits and character of the fur, all of the wolves are customarily placed in the extensive genus *Canis* along with the dogs and jackals. Excepting some of the domesticated varieties of dogs, wolves are the largest members of the family, and normally they howl and do not bark as do the dogs and jackals. Their natural range is throughout North America and Eurasia, but no true wolves are found in the Southern hemisphere, where they are replaced by the smaller carrion-eating jackals and fox-dogs. As they inhabit indifferently mountain-tops, plains and swamps, and are equally at home on the frozen Arctic shores and the tropical swamps of Mexico and India, they exhibit, as might be expected, a great range of variation. Generally they increase in size, vigor and courage northward, and the fur becomes more shaggy and thicker. The species and varieties have never been very satisfactorily discriminated and many zoologists consider that the large northern woodland wolf of both continents is a single wide-ranging variable species. Certainly these active animals are free to cross between the Old and New Worlds in the winter on the ice by way of Greenland or Alaska.

The American gray or timber wolf (*C occidentalis*) when full-grown measures five and one-half feet in length, whereof 18 inches belong to the tail; its height is 33 inches, and its weight over 100 pounds. The general aspect

is that of a large dog, and, indeed, domestic dogs of the Indians were partly derived from this species and some of the European varieties from the native wolf. They are lank, long-limbed creatures with erect ears and drooping, rather bushy tails; the hair of the neck is generally more or less elongated and erectile. The color is very variable, the prevailing tone being gray, more or less marked with black; and becomes paler in winter and more reddish in summer. Southward the colors deepen, leading to the black wolf (*C. ater*) of Florida, the red wolf (*C. rufus*) of Texas and the dusky wolf (*C. nubilus*) of the central plains, while in the far North the Arctic wolf (*C. albus*) is nearly pure white with a black tail-tip. The gray wolf was formerly very abundant and troublesome in most parts of North America, but has more rapidly and completely succumbed to the march of civilization here than in Europe, and long since disappeared from even the forest-clad portions of the Eastern States. At the present time wolves are practically extinct in the country east of the Mississippi River, but still roam in large packs in the northern and western Canadian forests and wooded swamps, and are especially large and plentiful in Newfoundland and the Hudson Bay region. Owing to their activity and restless wandering habits small parties are likely to appear in the winter at places where none have been known for years. As the habits of all large wolves are essentially similar the following account of the European wolf (*C. lupus*), which has remained much more generally plentiful and troublesome than ours, will answer for the whole group:

Wolves inhabit a great variety of country, both hill and plain, especially thick forests and broken ground, with alternate morasses and dry patches, and in the South the steppes. They shelter in woods, marshes, canebrakes and maize fields, roaming over wide areas, often suddenly appearing where none have been seen for years, and as quickly vanishing—nor is this wonderful when it is remembered that they will cover from 25 to 40 miles in a single night. In the neighborhood of dwellings they only appear after twilight, but in secluded places carry on their hunting all day. Their food varies according to the season, consisting in summer almost exclusively of wild animals—foxes, hedgehogs, mice, birds, reptiles and even vegetables; of larger animals, elk and deer, while hares are soon exterminated where wolves abound. While readily associating and interbreeding with large domestic dogs which have run wild, they frequently attack and devour house dogs and even weak or injured members of their own species. They follow herds of lemmings in their migrations, and will devour carrion with avidity; but they do not appear to attack man unless in large numbers or pressed by hunger. Accounts of such attacks in the latter part of winter are frequent in the European press and are occasionally reported from the woods of Minnesota, Michigan and the Canadas. In winter they approach nearer to human habitations, doing much damage to flocks of sheep and poultry. When in packs they will attack horses and cattle. In the chase the wolf exhibits all the cunning of the fox, and in addition courage and the capability of hunting in packs. These will even divide in parties, one following the trail of the quarry, the other endeavoring to intercept its retreat. In mental qualities the wolf is in every respect the equal of the fox; his caution is so great that he regards every unfamiliar object with suspicion, will not pass through a door if he can leap over the wall, and will not, unless famished, attack a tethered animal lest it should be the bait of a trap. When he sees himself captured his courage and ferocity at once forsake him.

In spring and summer wolves are solitary or in pairs, in the autumn in families and in the winter in packs. The pairing season is in December and January, when the males fight savagely together; those who are fortunate enough to secure a mate remain with her till the young are well grown. The young are born in burrows usually excavated by the wolves themselves, and during her confinement the female is fed by the male. The period of gestation is 63 days, and from three to nine (usually four to six) cubs are found in a litter; these are blind for 21 days, and are suckled for two months, but at the end of one month are able to eat half-digested flesh disgorged by the mother. They quit the parents in November or December, but many remain together six or eight months longer; they are full grown in three years, and live from 12 to 15 years. Wolves can readily be tamed when taken young, and then exhibit many of the characteristics of domestic dogs.

Notwithstanding the spread of civilization, the wolf is still widely distributed. Excluding thickly populated regions, it extends over almost the whole of Europe; but Russia and Scandinavia are the only parts where it now occurs in any large numbers. In Asia it is spread over all the continent to the borders of India and the plains of China.

Besides the American forms already mentioned many wolves inhabiting Europe and Asia has been described as species more or less distinct from *C. lupus*. Among these are *C. niger* and *C. laniger* of Tibet, *C. pallipes* of India, *C. hodophylax* of Japan and *C. mexicanus* of Mexico. The Indian wolf (*C. pallipes*) is smaller and slighter than the typical form, with little or no under-fur; but undoubted examples of *C. lupus* differ as much from each other as this does from them. It inhabits the plains south of the Himalayas, but is rare west of the Indus. It does not hunt in large packs, but in numbers of six or eight at most. The superstition of the people prevents its destruction, for they imagine that its blood will diminish the fertility of the fields. It is seldom heard, not howling like the European wolf. It is remarkable even among wolves for speed and endurance.

A second well-marked species of *Canis* found in North America is the prairie wolf (*C. latrans*). See COYOTE.

In Africa and South America several species of hunting dogs belonging to *Canis* and related genera are known locally as wolves, but the name is not properly applicable. Still less should it be applied to the "native wolf" of the Tasmanians, which is a true marsupial (*Thylacinus cynocephalus*) of carnivorous habits and canine aspect. Consult Mivart, 'Monograph of the Canidæ' (London 1890); Merriam, 'Revision of the Coyotes,' 'Proceedings,' Biological Society of Washington (1897);

Audubon and Bachman, 'Quadrupeds of North America' (New York 1847); Seton, 'Northern Mammals' (New York 1909), and books of travel and sport.

WOLF-FERRARI, Ermanno, Italian composer: b. Venice, 12 Jan. 1876. He studied under Rhineberger at Munich in 1893–95, and in 1902–09 he was director of the Liceo Benedetto Marcello, Venice. For some years after 1909 he lived at Munich, devoting himself to composition, chiefly operas, and later he lived in Venice. His operas are highly successful and are characterized by excellent technique and much charm of manner. He has composed several piano pieces, a large choral work, violin sonatas, and other works besides his operas, among which are 'La Sulamita' (1898); 'Cenerentola' (1900); 'Le Donne Curiose' (1903); 'Die vier Grobiane' (1906); 'Il Segreto di Susanna' (1909); 'I Gioiellj della Madonna,' 'Jewels of the Madonna' (1911); 'L'Amore Medico' (1913).

WOLF-FISH, a large voracious sea-fish (*Anarrhichas lupus*), allied to the blenny and named from the wolfish appearance given it by its great interlocking front teeth, and from its disposition to fight hard for its life when caught. It may attain a length of four or five feet. The color is an olive green above, marbled with brown on the head especially. The fish feeds on echinoderms, mollusks and crustaceans. The flesh tastes like that of cod. Several other species are known in various parts of the world constituting the family *Anarrhichidæ*.

WOLFBORO, N. H., town in Carroll County, on Lake Winnipiseogee, and on the Boston and Maine Railroad, about 43 miles northeast of Concord. It contains five villages. It has marble and granite works, boot and shoe factories, woolen mills, carriage and wagon works, flour mills and lumber works. The town has several churches, graded schools, Brewster Academy and a public library. Pop. about 2,224.

WOLFE, wŭlf, **Catharine Lorillard,** American philanthropist: b. New York, 28 March 1828; d. there, 4 April 1887. She inherited from her parents and grandparents a fortune of about $10,000,000, and expended a large portion of her income in benevolent works. Among her benefactions during her lifetime were liberal gifts to Saint Luke's Hospital, New York; $100,000 to Union College; the site and money gifts to the Fordham Home for Incurables; $65,000 to Saint Johnland, Long Island; a proselytizing Italian mission in New York, costing $50,000; a newsboys lodging house, costing with its endowment $170,000; $250,000 to Grace Church, New York; and generous contributions to the American chapels in Rome and in Paris, as well as to many schools and churches in the United States. She financed Dr. W. H. Ward's archæological expedition to Asia Minor in 1884. Through her will she left an endowment of $350,000 to Grace Church; and to the Metropolitan Museum, New York, she left her collection of paintings, together with an endowment fund of $300,000 for maintenance and enlargement.

WOLFE, Charles, Irish poet: b. Dublin, 14 Dec. 1791; d. Cove of Cork (now Queenstown), 21 Feb. 1823. He was graduated at Trinity College, Dublin, in 1814, was tutor there the next year, took orders in the English Church in 1817 and was curate of Donoughmore, Ireland. The poem which has secured his fame, 'Ode on the Burial of Sir John Moore,' was published in the *Newry Telegraph* (1816). Wolfe was also the author of several other poems, and his 'Remains,' with a 'Brief Memoir,' by John A. Russell, were published in 1825.

WOLFE, James, English general: b. Westerham, Kent, 2 Jan. 1727; d. Quebec, Canada, 13 Sept. 1759. He was educated at Westerham and Greenwich, and in 1741 received an ensign's commission in a foot regiment. In 1743 he took part in the famous battle of Dettingen; in 1744 obtained his captaincy; and in 1745–46 was present at the battles of Falkirk and Culloden. In 1747 he was wounded, though not seriously, at the battle of Lawfeldt, and from 1749 to 1757 was engaged in garrison duty in Scotland and England. In the mismanaged expedition against Rochefort (1757) Wolfe acted as quartermaster-general and the only creditable movement in the affair was a night reconnoissance conducted by him which penetrated two miles into the enemy's country. His recommendation in favor of an immediate attack and his offer to take the place with 500 men and three ships were unheeded; but Pitt, becoming acquainted with the facts of the case, kept the young officer in view for some future enterprise. This occurred in the following year, when Wolfe was ordered to accompany the expedition under Amherst to Cape Breton, with the rank of brigadier-general. A brilliant success was obtained in the capture of the strong fortress of Louisburg, after a seven weeks' siege, and he became popularly known as the "Hero of Louisburg." Pitt was then planning the overthrow of the French dominion in North America by the capture of their chief stronghold, Quebec, and with the instinct of genius singled out Wolfe as the most promising young officer in the army, to command the expedition, notwithstanding many older officers might by virtue of seniority have claimed the honor. Wolfe was accordingly created a major-general, and in 26 June 1759 landed his forces on the Isle of Orleans, opposite Quebec. The system of defense adopted by his adversary, Montcalm, was such as to offer no point of advantage. The season during which operations could be continued rapidly advanced, but at last having dropped down the river and scaled the precipitous cliffs known as the Heights of Abraham at a point insufficiently guarded, at daybreak of 13 September, Wolfe found himself on the Plains of Abraham, where, his supplies thus cut off, Montcalm had no choice but to give battle. After a short struggle the French were driven from the field in complete rout; Montcalm was one of the 500 killed; the capitulation of Quebec followed five days after; and its fall decided the fate of Canada. Wolfe died in the hour of victory. In person he led the right, till thrice wounded, he was carried to the rear. He lived to hear the cry, "They run; see how they run!" and expired with the words, "Now God be praised, I will die in peace." His body was taken to England and buried in Greenwich Church, and a monument was

erected to him in Westminster Abbey. Consult Allison, 'Memoir of Wolfe' (in 'Twelve English Soldiers Series'); Bradley, 'Wolfe' (in 'English Men of Action Series,' 1895); Casgrain, H. R., 'Wolfe and Montcalm' (Toronto 1905); Parkman, F., 'Montcalm and Wolfe' (in 'France and England in North America,' 2 vols., Boston 1898); Willson, B., 'The Life and Letters of James Wolfe' (London 1909); Wright, R., 'The Life of Major General Wolfe' (ib. 1864).

WOLFE, Theodore Frelinghuysen, American author: b. Kenvil, N. J., 1847; d. 1915. He was graduated from the medical department of Columbia in 1868, and for several years practised his profession in Jersey City, N. J. He has published 'Literary Shrines of American Authors' (1895); 'A Literary Pilgrimage Among Haunts of British Authors' (1896); 'Literary Haunts and Homes of American Authors' (1898); 'Literary Rambles at Home and Abroad' (1900).

WOLFE ISLAND, Canada, at the northeast end of Lake Ontario, bisects the outlet of the Saint Lawrence River, and is about 18 miles long, with a maximum width of seven miles, and an area of 34,806 acres. It belongs to Frontenac County, Ontario, is the largest of the famous Thousand Islands and is opposite Cape Vincent, New York State. Its coast is indented with picturesque bays, it is well-wooded and the surrounding waters abound with fish. Pop. about 2,000.

WOLFENBÜTTEL, vŏlf'ĕn-büt-tĕl, Germany, a town of Brunswick, on the Ocker, seven miles south of Brunswick. One of the ancient churches contains many of the tombs of the princes of Brunswick. The old castle now accommodates a seminary for teachers and a theatre. The library opposite, built in 1723 in the form of the Pantheon at Rome, became famous for its literary wealth and for the fact that Lessing (q.v.) was its librarian. It was Lessing who edited the 'Wolfenbüttel Fragments,' professedly from anonymous manuscripts under his charge, but really from the pen of his friend Reimarus (q.v.), which startled the theological world of Germany. The Pantheon building had become so rickety and dangerous that it had to be taken down, being superseded in 1887 by a handsome new edifice, which houses 300,000 volumes and 10,000 manuscripts. There are in the town manufactures of machines, copper goods, flax, cloth, corks, leather, preserves, tobacco, etc. The place is very ancient, and dates from 1046; it was besieged and taken in 1193 and 1542; and during the Thirty Years' War a battle was fought here in 1641. Pop. 17,916.

WOLFF, vŏlf, **Albert,** German sculptor: b. Neutrelitz, Mecklenburg, 14 Nov. 1814; d. Berlin, 20 June 1892. In 1831 he entered Rauch's studio in Berlin, and in 1844 was sent to Carrara to execute the sculptures for the terraces of the Sans Souci Palace. Upon his return from a sojourn in Italy of nearly two years, he assisted Rauch in the completion of the latter's Frederick the Great memorial for Berlin. In 1849 he became a member of the Berlin Academy, in 1858 professor there, and in 1866 a member of its senate. He was three times the victor in competition for equestrian statues —in 1861 for that of King Ernest August (Hanover), in 1875 for that of King Frederick William III (Berlin), and in 1885 for that of General Artigas (Montevideo). Among his further works are busts of German notabilities, including von Moltke; a decorative bronze group, 'The Lion-tamer,' for the Berlin Museum building; colossal statues of the 'Four Evangelists' for the Schlosskirche, Neustrelitz; one of Frederick William IV in Königsberg, and other portrait and ideal productions.

WOLFF, Albert, French journalist: b. Cologne, Germany, 31 Dec. 1835; d. Paris, 22 Dec. 1891. He studied at the University of Bonn, settled in Paris in 1857, where he became secretary to Alexandre Dumas, Père, and in 1859 began to contribute to the *Gaulois Figaro, Charivari,* etc. Some of these articles, collected in book form, were afterward published as 'Memoirs of the Boulevard' (1866); 'The Two Emperors' (1871); 'Victorien Sardou and Uncle Sam' (1873), etc. He wrote also several novels and farces.

WOLFF, Christian, German philosopher and mathematician: b. Breslau, 24 Jan. 1679; d. Halle, 9 April 1754. He studied at Jena theology, mathematics and philosophy, paying particular attention to the writings of Descartes and Tchirnhausen, and writing an elucidatory commentary on the 'Medicina Mentis' of the latter, which circumstance was the occasion of an intimacy between him and Leibnitz. In 1707 he was called to Halle as professor of mathematics. By his rationalistic views he here incurred the hostility of certain theologians who denounced him and by an order from the government of Frederick William I he was commanded (1723) to resign his office, leave Halle in 24 hours and the Prussian States in two days. But he was ultimately vindicated, and in 1740 appointed by Frederick II vice-chancellor and professor in the University of Halle. Three years later he was made chancellor of that university. The principal service rendered by Wolff to the progress of learning consisted in his persistent application of mathematical methods to the investigations of physical science. The decided rationalism which characterized his philosophical doctrine resulted in a popularization of the Leibnitzian teaching. While appropriating many of the conceptions of Leibnitz he controverted his monadology, and regarded the theory of pre-existent harmonies as a mere hypothesis, while he asserted the possible interaction of body and soul. Like Wolff, Kant in his 'Critic of Pure Reason' divides philosophy into Ontology, Cosmology, Rational Psychology and Natural Theology. His collected works make up 22 volumes. Consult Arnsperger, 'Christian Wolff's Verhältniss zu Leibnitz' (1897); Lewes, 'Biographical History of Philosophy'; Pichler, 'Ueber C. Wolff's Ontologie' (1910); Piur, 'Studien zur sprachlichen Würdigung C. Wolff's' (1903); Watcke, 'Wolff's eigene Lebensbeschreibung' (Leipzig 1841).

WOLFF, Emil, German sculptor: b. Berlin, 2 March 1802; d. Rome, Italy 29 Sept 1879. He was a pupil of his uncle, Gottfried Schadow, and having gained a prize at the Royal Academy of Arts went to Italy in 1822 as a pensioner of Frederic William III, and ever after

resided in Rome. Here he came under the influence of Thorwaldsen, and in 1871 was appointed director of the Academy of Saint Luke. He held high rank among German sculptors and executed many Greek mythological and genre statues which have been greatly admired. In portraiture, busts of Niebuhr, Thorwaldsen, Winckelmann and Bunsen are among his masterpieces. Among his noteworthy productions are 'The Fisherboy' (1833); 'Victory Teaching Youth History' (1846); 'Circe' (in the National Gallery at Berlin).

WOLFF, wŭlf (Ger. *vŏlf*), **Joseph**, Anglo-German missionary: b. Weilersbach, near Bamberg, Germany, 1795; d. Isle Brewers, Somerset, 2 May 1862. He was the son of a rabbi, but became a Christian, taught Hebrew for a time at Frankfort and Halle, studied at Munich, Weimar and Vienna, and in 1815 went to Rome. He entered first the Collegio Romano, and in 1817 the College of the Propaganda, intending to become a missionary. Dismissed for heresy in 1818, he went to England, joined the English Church, spent two years at Cambridge, studying Oriental languages, preparatory to going as a missionary to the Jews in Palestine, and in April 1821 embarked for Gibraltar. After an extensive tour in the East he returned to England in 1826. In 1827, he married Lady Georgiana Walpole, a daughter of the Earl of Orford, and in April of the same year set out on another missionary tour, and at Jerusalem was poisoned by some bigoted Jews and narrowly escaped death. On his recovery he set out for Bokhara by way of Persia, and on the journey encountered the plague, was repeatedly robbed, was taken prisoner and sold as a slave, but finally reached Bokhara. He spent some time in Abyssinia, acquired the Amharic language and returned to England in 1834. In January 1836 he again visited Abyssinia, where he was worshipped by the natives as their new aboona or patriarch, visited the Rechabites of Yemen, met a party of Wahabees in the mountains of Arabia, who horsewhipped him because they could find nothing in the Arabic Bibles he had given them about Mohammed, and in August 1837 came to New York. Here he received deacon's orders in the Protestant Episcopal Church, visited the principal cities, preached before Congress and in January 1838 returned to England. He next visited Dublin, received priest's orders, and held several curacies in England. He went again to Bokhara in 1843 in the employ of the English government to obtain the release of Colonel Stoddart and Captain Connolly, but was imprisoned and saved from death only by the effort of the Persian Ambassador. He then returned to England in 1845, and after this eventful career spent the rest of his life in charge of the secluded parish of Isle Brewers, Somerset. He published 'Researches and Missionary Labors among Jews and Mohammedans' (1835); 'Journal of Missionary Labors' (1839); 'A Narrative of a Mission to Bokhara' (1845); 'Travels and Adventures,' an autobiography (2 vols., London 1860).

WOLFF, Julius, German poet and novelist: b. Quedlinburg, in the Harz Mountains, 16 Sept. 1834; d. 1910. He studied literature and philosophy at Berlin, then entered the manufacturing business of his father, but later withdrew, and in 1869 founded the *Harz News*. In 1870–71 served in the German army and won the Iron Cross. After this he settled in Berlin and devoted himself to literary work. His chief works are 'Aus dem Felde,' war poems (1871; 1907); 'Tyll Eulenspiegel redivivus' (1874; 23d ed., 1896); 'The Rat-catcher of Hameln' (1876); 'The Wild Huntsman' (1877); 'Tannhauser' (1880); 'Lurlei' (1886); 'Der fahrende Schüler' (1900); while among his novels may be cited 'Der Sülfmeister' (1883); 'Der Raubgraf' (1884); 'Die Hohkönigsburg' (1902). Consult Ruhemann, 'Julius Wolff und seine Dichtungen' (Leipzig 1886).

WOLFF, Oskar Ludwig Bernhard, German improvisator and novelist: b. Altona, 26 July 1799; d. Jena, 16 Sept. 1851. He studied medicine in Berlin and subsequently history and philosophy. He became professor of modern languages at Weimar, in 1826, and of modern languages and literature at Jena, in 1832. He published 'Pictures and Songs' (1840); 'Natural History of the German Student' (1841); 'Bubbles and Dreams' (1844); 'The Minor Ills of Human Life' (1846); 'History of the Novel' (2d ed., 1850), etc.; and edited 'Treasury of National Poetry' (4th ed., 1853); 'Treasury of German Prose' (11th ed., 1875); 'The German People's Treasury of Poetry' (28th ed., 1884), etc.

WOLFF AGENCY, the most powerful news agency in Germany, ranks with Reuter's of London and Havas of Paris. Before the outbreak of the European War in 1914, the Wolff Agency was a private concern doing its greatest business in Germany and Austria, the Norse countries and Russia, though its news service reached all parts of the world. In 1917 the control of the Wolff Agency passed into a syndicate of militarists representing the German government. This increased its influence and power in the German-speaking countries. See PRESS ASSOCIATIONS.

WOLFHOUND, a dog kept and trained for the pursuit of wolves. The ancient Irish wolfhound, now extinct, was of two kinds. One was a tall, shaggy, swift-running dog, somewhat like the modern Scottish deerhound; the other more nearly resembled a mastiff, and similar dogs have been known in Spain under the name of wolf dogs. The modern Russian wolfhound is the beautiful borzoi (q.v.).

WOLFRAM VON ESCHENBACH, mediæval German epic poet: b. Eschenbach, near Ansbach, Middle Franconia, Bavaria, about 1170; d. perhaps at the same place, about 1219 (?). He was of noble Bavarian family, and served various powerful overlords, such as the counts of Wertheim, the Landgraf Hermann von Thüringen (at whose court he lived about 1203, and who provided him with the material for Wolfram's 'Willehalm,' namely, the *chanson de geste*, 'Bataille d'Aliscans') After the death of Hermann in 1217 he is said to have retired to his native province, perhaps to Wildenberg (Wehlenberg); his remains are reported to have been interred in the church of Our Lady at Eschenbach. Of all the epic poets who wrote in Middle High German, Wolfram has the strongest personality, the

most original artistry and the most mature moral and religious feeling. Although in point of style and passion he is excelled by Gottfried von Strassburg, he stands alone in mediæval German literature in the realism of his observation, the depth of his psychology, the sanity and originality of his views and a broad toleration and sense of humor. Eight songs and three epics are the sum of his work, as far as it has been preserved. The greatest of these is the epic 'Parzival' (finished 1208, preserved in 15 complete manuscripts), probably based on the "Percival" in 'Li contes du graal' of Chrestien de Troyes (q.v.); but Wolfram mentions another authority 'Kyot, den meister wolbekant.' In this long biography, in 25,000 lines of verse, Wolfram presents a picture of tolerant spiritual knighthood, as distinguished from the traditional ideals of chivalry, such as his profoundly generous and balanced nature would evolve it. Thus, he exalts the calm happiness of the state of wedlock as opposed to the conventional intrigue and exaggeration of the minnesingers and their cult of romantic affection. Again, in the epic fragment 'Sigune und Schionatulander' (also called 'Titurel'), he decries the unnatural etiquette of the courts and their knightly *minne*. In the incomplete epic 'Willehalm' the underlying idea is the principle of Christian toleration toward pagan opponents. Editions of the original text have been published by Karl Lachmann (Berlin 1891); Martin, E., (Halle 1900); Leitzmann, A. (Halle 1902); modern German translations by K. Simrock (Stuttgart 1883); Hertz (Stuttgart 1906). Consult San Marte, 'Parzivalstudien' (3 vols., Halle 1861); Martin, E., 'Zur Gralsage' (Strassburg 1880); Grimm, 'Wolfram von Eschenbach und die Zeitgenossen' (Leipzig 1897).

JACOB WITTMER HARTMANN.

WOLFRAMITE, a native tungstate of iron and manganese in varying proportions, having the formula $(Fe,Mn)WO_4$. It occurs in flat, monoclinic crystals, with eminent cleavage parallel with the clinopinacoid. It is brittle, has a hardness of 5 to 5.5 and a specific gravity of 7.2 to 7.5, or about that of iron. It has a submetallic lustre, while it is almost or quite opaque and its color and streak are black or nearly black. It is thus distinguished from the closely related mineral hübnerite. It usually occurs in quartz veins, frequently associated with cassiterite or scheelite. It is of considerable commercial importance as a source of tungsten, the ferro-tungsten used in making tungsten steel being derived from it. Its best-known localities have been in Bohemia, Saxony and England, but the recent increased demand for it has brought other localities into prominence, among which are those of New South Wales, Argentina and Connecticut. Much so-called wolframite is really hübnerite.

WOLF'S-BANE. See ACONITE.

WOLGAST, vōl'gäst, Prussia, town of Pomerania, on the left bank of the Peene, four and a half miles from its influx into the Baltic, and 40 miles southeast of Stralsund by rail. Its harbor is shallow and larger vessels load and unload on the Ruden, an island at the river mouth. Wolgast has the remains of an old castle, the ancestral seat of the Dukes of Pomerania. Its industries are weaving, boat building and the manufacture of leather and tobacco. It has also an active trade in ships' stores. Wolgast, which was strongly fortified early in the 12th century, was destroyed in 1628 by Wallenstein, in 1630 by the Swedes, in 1637 by the Imperialists and in 1638 again by the Swedes. In 1675 it was taken by the Great Elector, was plundered by the Russians in 1713, and by the Swedes again in 1715. But small remains now exist of its former fortifications. Pop. about 10,000. Consult Heberlein, B., 'Beiträge zur Geschichte der Burg und Stadt Wolgast' (Wolgast 1892).

WOLLASTON, wůl'ăs-tŏn, **William Hyde,** English chemist; b. East Dereham, Norfolk, 6 April 1766; d. London, 22 Dec. 1828. He was educated at Cambridge and was graduated in medicine in 1793. He practised as a physician in Bury Saint Edmunds, and then removed to London, where he presently devoted himself to scientific research, becoming secretary of the Royal Society in 1806, and its president in 1820. He was the inventor of the camera lucida (q.v.), and also the goniometer, an instrument for measuring the angles of crystals, and the discoverer of palladium and rhodium, in 1803, and the malleability of platinum, for which latter discovery he received the medal of the Royal Society in 1820, and which brought him $150,000. Wollaston was a member also of the Geological Society of London, to which he bequeathed a sum providing for the Wollaston medal. This award which is bestowed in recognition of "researches concerning the mineral structure of the earth" is the highest honor the society confers. Many of his papers on research work were published in 'Philosophical Transactions' and others in the 'Annals of Philosophy.'

WOLLASTON LAKE, Canada, a lake of Athabasca, in the Northwest territory. It is about 50 miles long and has its outlet in the Mackenzie River.

WOLLASTON LAND, Canada, a region of Franklin territory, lying west of Victoria Land, in the Arctic Ocean.

WOLLASTONITE, one of the pyroxene group of minerals, crystallizing, therefore, in the monoclinic system. Its crystals are usually tabular, to which fact its name "tabular spar" is due. Crystals are, however, rather rare, the common occurrences being compact or in aggregates of brittle fibres, having a splintery fracture. Its hardness is 4.5 to 5, and specific gravity 2.85. Its lustre is vitreous to pearly and its usual color is white or gray. Some localities yield specimens which show excellent triboluminescence. It is a calcium metasilicate, $CaSiO_3$. Its most important American localities are in northern New York. It was named in honor of the eminent English chemist, W. H. Wollaston.

WOLLE, John Frederick, American musician; b. Bethlehem, Pa., 4 April 1863. He studied under Wood at Philadelphia in 1883–84; under Rheinberger at Munich in 1884–85; and later studied the organ under S. P. Warren in New York. He was organist at the Moravian Church at Bethlehem in 1885–1905 and also of the Packer Memorial Church at Lehigh Uni-

versity in 1887–1905. In 1905–12 he was professor of music at the University of California; and in 1912 he resumed his former positions at Bethlehem. He established the annual Bethlehem Bach Festivals in 1898; the Choral Society at Harrisburg, Pa., in 1914; the Oratorio Society at York, Pa., in 1914; and the Oratorio Society at Lancaster, Pa., in 1916. He received the degree of Mus. Doc. from Moravian College in 1904. From 1916 he was organist of Trinity Church, Bethlehem. He is considered one of the leading organists in America.

WOLLIN, vŏl-lēn', Germany, an island of Prussia at the mouth of the Oder; on the north side of the Great Haff; length, 20 miles; breadth from 3 to 10 miles. Fishing and cattle-rearing are the chief occupations. Pop. 14,000.

WOLLSTONECRAFT, wŭl'stŏn-krăft, Mary. See GODWIN, MARY WOLLSTONECRAFT.

WOLSELEY, wŭlz'lĭ, SIR **Garnet Joseph**, 1ST VISCOUNT, British soldier: b. near Dublin, 4 June 1833; d. 1913. He entered the army in 1852 as an ensign, served in the Burmese War of 1852–53, went through the Crimean campaign and was severely wounded before Sebastopol. For his services here he was made a member of the Legion of Honor, and in 1855 was advanced to the rank of captain. He saw active service in India during the Mutiny, from 1858 to 1860 was attached to the Bengal command, took part in the brief China War of 1860, and in 1865 attained the rank of colonel. He was assistant quartermaster-general and deputy quartermaster-general in Canada 1867–70, and in the latter year led the successful Red River expedition against Louis Riel. On leaving Canada he received the appointment of assistant adjutant-general at headquarters, a post which he held until 1873. In the Ashanti War in 1873–74 his admirably planned march resulted in the capture of Kumasi, the native capital, and led to the securing of British authority on the Gold Coast. In 1875 he went to Natal as imperial commissioner, in 1878 was promoted to the rank of lieutenant-general, and went to Cyprus in the capacity of high commissioner and commander-in-chief. Leaving Cyprus next year he was again sent to South Africa, this time as governor and high commissioner of Natal and the Transvaal in order to finish the Zulu War and check the advance of Secocoeni. On returning home in 1880 he was appointed quartermaster-general of the army, a post which he held till 1882, when he was advanced to the rank of adjutant-general, and as commander-in-chief conducted the campaign in Egypt against Arabi Pasha, which ended in the utter defeat of the latter at Tel-el-Kebir. For this he was raised to the peerage as Baron Wolseley of Cairo and of Wolseley, in the county of Stafford. He commanded the Nile expedition of 1884–85, which was sent too late too relieve General Gordon in Khartum, nevertheless because of his efficient service he was created Viscount Wolseley of Wolseley on his return, and made a Knight of the Order of Saint Patrick. In 1890 he was appointed to the command of the forces in Ireland, becoming at the same time privy councillor of Ireland, and in 1895 succeeded the Duke of Cambridge in the post of commander-in-chief in the United Kingdom. He was succeeded in the latter post by Lord Roberts on his return from South Africa in 1900. He has published 'Narrative of the War with China in 1860' (1862); 'The Soldier's Pocket-Book for Field Service' (1869; 1882); 'The Life of John Churchill, Duke of Marlborough, to the Accession of Queen Anne' (1894); 'The Decline and Fall of Napoleon' (1895); 'The Story of a Soldier's Life' (1903). Consult Low, 'Memoir of Sir Joseph Garnet Wolseley' (1878).

WOLSEY, wŭl'zĭ, **Thomas**, English statesman and cardinal: b. Ipswich, Suffolk, March 1471 (according to others about 1475); d. Leicester, 29 Nov. 1530. He was the son of a butcher and was sent to Magdalen College, Oxford, of which he became a bachelor at 15 and was elected Fellow. Being appointed master of a grammar-school dependent on the college, he had three sons of the Marquis of Dorset under his care, which led that nobleman to present him to the living of Limington, in Somerset. He was afterward chaplain to the archbishop of Canterbury, then to one of the governors of Calais and finally was recommended to Henry VII, who made him one of his own chaplains. Under Henry VIII his progress in advancement was very rapid. In 1509 he was made dean of Lincoln; in 1510 became rector of Torrington; in 1511, canon of Windsor, registrar of the order of the Garter and privy councillor; in 1513 dean of York and bishop of Tournay (being then in France); in 1514, bishop of Lincoln and then archbishop of York. In 1515 Pope Leo X elevated him to the dignity of cardinal, and in the end of the same year Henry made him lord-chancellor. His nomination in 1518 to be the Pope's legate *a latere* completed his ecclesiastical dignities, by exalting him above the archbishop of Canterbury. At the time when the rivalry between the Emperor Charles V and Francis I rendered the friendship of Henry of great importance Wolsey was treated with the greatest respect by both sovereigns, receiving pensions from each, as well as a third from the Pope. He ultimately, however, favored the side of Charles, who settled upon him the revenues of two bishoprics in Spain and flattered him with hopes of the Papal chair, which induced him to involve Henry in a war with France. Insatiable in the pursuit of ecclesiastical emolument, in 1519 he gained the administration of the see of Bath and Wells, and the temporalities of the abbey of Saint Albans, his revenues now nearly equaling those of the Crown. Part of them he expended in pomp and ostentation and part in laudable munificence for the advancement of learning. His love of splendor was signally displayed on the Field of the Cloth of Gold in June 1520; his love of learning in his foundation of several lectures, as well as the college of Christ Church at Oxford, and of a collegiate school at Ipswich. He built a palace for himself at Hampton Court, but this he in the end presented to the king. In 1522, on the death of Leo X and again in 1525, on the death of Adrian VI, he failed to secure elevation to the papacy, and on both occasions attributed his failure to Charles V, to whom he ever afterward entertained a strong aversion. The critical affair of the divorce of Queen Catharine was one of the first steps to his fall. With Cardinal Campeggio he was appointed to determine the legitimacy of Henry's marriage

with her, and lost the favor of the king by exposing himself to the suspicion of causing delays in the settlement of the question. He fell still more into disfavor by advising the king against marrying Anne Boleyn, and of course roused the hostility of Anne herself and her friends. Leading nobles deeming this a good occasion for contriving his ruin, caused him to be accused of having in the exercise of his duties of papal legate violated the statute of præmunire (1529), and he was convicted. The Dukes of Norfolk and Suffolk were sent to require the great seal from him, he was ordered to quit York Palace, his palace in London and retire to Esher, in the diocese of Winchester, and his lands, goods and chattels were declared forfeited. Henry still assured him of his protection. Part of his revenues were restored to him and he was even reinstated in the diocese of York. But Henry did not continue his protection long. Toward the close of the year 1530 he was arrested at his mansion of Cawood, in the diocese of York, whither he had retired, and was ordered to be conveyed to London on a charge of high treason. Illness and mental distress obliged him to stop at Leicester, where he was well received at the abbey and where he died a few days afterward. Shortly before his death he is said to have exclaimed to the officer appointed to conduct him: "Had I but served God as diligently as I have served my king, he would not have given me over in my gray hairs." There has been considerable disposition in later writers to vindicate the character of this minister; and it must not be forgotten that, in the reign of Henry VIII, who had broken his heart; of Mary, the daughter of the much-injured Catharine; and of Elizabeth, whose mother (Anne Boleyn) was the chief instrument of his downfall, scant justice could be expected to be rendered to the bettter traits of his mixed character. If he was loose in his morals, grasping in his ambition and rapacious, he was liberal and even profuse toward his dependents, and in his patronage of letters. He was enlightened far beyond the period in which he lived. As a diplomatist it is very difficult to say whether his abilities or industry were the most remarkable, and it is to him that England is indebted for the first notion of a vigorous police and for a regular system in the administration of justice. Consult 'Life' by Cavendish (1641) and 'Lives' by G. Howard (1824); C. Martin (1862); Brewer, J. S., 'Reign of Henry VIII' (London 1884); Creighton, M., 'Cardinal Wolsey' (ib. 1888; new ed., 1903); Gardiner, J., "The Fall of Cardinal Wolsey" (in 'Transactions of the Royal Historical Society,' ib. 1899); Gasquet, 'The Eve of the Reformation' (1892); Law, E., England's First Great War Minister' (London 1918); Taunton, E. L., 'Cardinal Wolsey' (London 1900); Williams, 'Lives of the English Cardinals' (1868).

WOLVERHAMPTON, wŭl-vẽr-hămp'tŏn, England, a manufacturing town, the "metropolis of the Black Country," is built on an eminence amid a network of railways and canals, 13 miles northwest of Birmingham and 126 northwest of London. The town stands on the western edge of the great coal and iron mining district of South Staffordshire, so that the vicinity on the south and east is covered with collieries, ironstone mines, blast furnaces, forges, iron foundries and rolling mills, while on the north and west there is pleasant green country. It was first called "Hamton" and then "Wulfrunishamton," after Wulfruna, King Edgar's sister, had founded in 996 Saint Peter's Church, which continued collegiate till 1846. It was rebuilt during the 13th, 14th and 15th centuries and enlarged and elaborately restored. The church is a fine cruciform Gothic edifice, with several notable features and monuments. The other public buildings are all modern and include the town-hall, corn exchange, market-hall, agricultural hall, hospitals, postoffice, art gallery, drill-hall, etc. The free grammar-school, founded in 1512, occupies handsome new buildings of 1876; and there are also a blue-coat school (1710) and an orphanage (1850). In 1757 Wolverhampton was described as "a great manufacturing town in all sorts of toys, and particularly of locks in the greatest perfection"; locks — some 2,000,000 yearly — are still its specialty. The other manufactures include tin plate, japanned goods, enameled hollow wares, edge tools, gas and water tubes, electro-plate, papier-maché, chemicals, etc. Pop. 95,333.

WOLVERINE, GLUTTON, or **CARCAJOU,** a carnivorous mammal (*Gulo luscus*), of the weasel family (*Mustelidæ*), but differing greatly in appearance from the light and slender weasels typical of that family. The wolverine is a short, thick, heavily-built animal about two and one-half feet long, whose short legs, sub-plantigrade feet and short, bushy tail add to a decidedly bear-like aspect of body. On the body and especially on the tail the hair is long, coarse and rough, blackish-brown with a pair of yellowish lateral bands meeting at the root of the tail above. The teeth are 38 in number and the molars are remarkable for their massiveness. The wolverine is a northern animal entering the United States only along the Canadian border, and even there very rare.

Apparently there is no distinction between the glutton of northern Europe and Asia and the American wolverine, and in both Old and New Worlds this brute is hated alike by woodsmen and trappers for its voracity, native meanness and cunning. It has the reputation of being the most powerful mammal of its size in existence, and in dogged courage is said to have no equal. Those who have had experience with it place it ahead of even the coyote in craftiness and the ingenuity which it exhibits in finding and robbing the stores of man and beast. It systematically follows the lines of traps set by fur hunters and robs them of both baits and captured animals; but is itself one of the most difficult of animals to take, and succeeds in repeatedly springing and robbing traps set for it, even when most cunningly concealed. Nor is its thieving confined to things edible; sometimes every portable article in a camp equipment will be carried away and hidden by a wolverine. It devours enormous quantities of food and its European name indicates that it is the type of greedy voracity. It lives on hares, squirrels, beaver, mice, foxes, all kinds of ground birds and their eggs, reptiles, insects, and even such large game as reindeer, which it is enabled to secure by its perseverance, great strength and cunning. The wolverine finds its most con-

genial home in the great northern forests, but its range extends beyond the tree line to the Arctic shores. Early spring is the mating season, and four or five young are born in June or July in a nest at the bottom of a burrow. The savage courage with which the female will defend her young is almost proverbial among trappers, who dread few animals so much as a mother wolverine with her family. Consult Coues, 'Fur-bearing Animals' (Washington 1877); Seton, E. T., 'Life Histories of Northern Animals' (New York 1909).

WOLVERINE STATE, a popular name for the State of Michigan, so called for its abounding in early days with wolverines.

WOMAN, Education of. See EDUCATION OF WOMEN.

WOMAN SUFFRAGE. All political revolutions have had for their primary object the desire of the revolutionists for a voice in their own government. Men for obvious reasons have taken the largest part in them, but women have assisted in all and yet when a voice in the government has been obtained men have claimed the right to speak for women as well as themselves. Women in the mass, living in isolated homes, in early days absorbed in all engrossing household duties, without education, pecuniary independence or organization, bound by social customs and the traditions of ages, have submitted to this usurpation of authority. There are preserved in history, however, enough instances to show that individual women did protest by voice, by pen and by petition. In Italy, where the universities were open to women in the 14th and 15th centuries; they demanded equality of rights. In England, which was the cradle of representative government, the records show that in 1499 women signed a petition for the right to a vote, and this was followed by others.

Mistress Margaret Brent brought this spirit with her to the American colony of Maryland, where in 1647, as heir of Lord Calvert, a brother of Lord Baltimore, and executor of the estates of both in the colony, she demanded "place and voyce" in its assembly, or legislature. Representation in England was based on property and this with other English laws was established in the American colonies. Although the demand of Mistress Brent was refused, the records show that some women property-owners voted in Virginia, and that in Massachusetts under the Old Province Charter women property-holders voted from 1691 to 1780. When a constitution was adopted they were excluded from a vote for governor and legislature but retained it for other officials. Under the close restrictions not one-fourth of the men could vote. Doubtless the hard conditions of domestic life for women in those days precluded any desire or attempt to take part in public affairs.

The American Revolution, based on the fundamental principle of "no taxation without representation," could not fail to rouse in women a sense that they were entitled equally with men to representation. That it did so is evidenced by the famous letter of Abigail Adams to her husband, John Adams, while he was sitting in the Continental Congress. "I long to hear that you have declared an independency, and, by the way, in the new code of laws, which I suppose it will be necessary for you to make, I desire you would remember the ladies and be more generous and favorable to them than were your ancestors. Do not put such unlimited power into the hands of husbands. Remember all men would be tyrants if they could. If particular care and attention are not paid to the ladies we are determined to foment a rebellion and will not hold ourselves bound to obey any laws in which we have no voice or representation." As Mrs. Adams used the plural "we" she undoubtedly spoke also for Mrs. Mercy Otis Warren, Mrs. Hannah Lee Corbin and other women of influence closely associated with the leading men of the Revolution. In 1778 Mrs. Corbin, sister of Richard Henry Lee, of Virginia, presented her own petition for the right to vote.

It is not likely that Mary Wollstonecraft heard of these protests, but in 1790 she published in London her remarkable book, 'Vindication of the Rights of Women.' In the French Revolution of 1793 Condorcet and other leaders proposed conferring political rights on women. During the preceding four centuries and doubtless in far earlier times treatises were written by men in various countries calling for the education, development and emancipation of women. [Plato in his 'Republic,' 5th century B.C.] Old manuscripts on the rights of women are in existence dated through the 16th and 17th centuries, but all of these were only individual protests made at long intervals.

In the 18th century the idea and the hope of political liberty were everywhere permeating the minds of men and found practical expression through the American Revolution. The Declaration of Independence was written as a guide for all countries, and with this and the Constitution of the United States, framed 1787–89, was begun the greatest experiment ever made in representative government, even though the makers of these documents did not contemplate giving to women a voice in this government. The Constitution did not in fact confer the suffrage on any one but left those who already possessed it entirely free, under the jurisdiction of the State governments, to grant it to or withhold it from any class of citizens. The religious qualifications had practically ended with the colonies. Some of the new States made property or educational requirements and others imposed both; all of them restricted voting to *male* citizens except New Jersey, whose constitution gave the franchise to "all inhabitants worth $250, etc." In 1790 a revision of the Election Law used the words "he or she," thus emphasizing the inclusion of women in the electorate. Enough women voted to gain the enmity of the politicians and in 1807 the legislature passed an arbitrary act limiting the suffrage to "white male citizens." This was clearly illegal, as the constitution could be changed only by action of the voters.

In the third decade of the new government most of the States, influenced by Jackson, Jefferson and others of democratic tendencies, removed the restrictions which barred the working men from the electorate, and this made the discrimination against women still more apparent. In 1826 a talented and wealthy young Scotchwoman, Frances Wright, having heard

glowing accounts of this land of individual liberty, came here and associated herself with Robert Dale Owen, then making some advanced social experiments, in the publication of his paper. She was greatly surprised to learn that women had no part in the government and for several years in the paper and on the platform she urged the enfranchisement of women and was the first to bring the question before the public. She was followed in 1836 by Ernestine L. Rose, daughter of a rabbi in Poland, who had been banished because of her progressive ideas. She was only 26, handsome and eloquent, and her lectures on the science of government were largely attended. She, too, was amazed at the subordinate position of women and not only advocated their full enfranchisement but also the repeal of the unjust laws under which they suffered. In the winter of 1836–37 she herself circulated a petition in Albany, N. Y., for a law to enable a married woman to hold property, and, although she could get only five signatures, she carried these to the legislature and addressed that body. She kept up this work, which soon attracted attention, and by 1840 she had associated with her Elizabeth Cady Stanton and Paulina Wright Davis, two brilliant young married women, and Lydia Mott, a well-known social reformer in Albany. In many localities there began to be signs of an awakening on the part of women. Margaret Fuller, one of a coterie of thinkers in Boston, in her writings and semi-public addresses in 1840 demanded political rights for women and published her book, 'The Great Lawsuit, Man vs. Women.'

Meanwhile larger forces were moving for the development of women and the extension of their rights. The anti-slavery question was growing more momentous. In 1828 Sarah and Angelina Grimké, of South Carolina, emancipated their slaves, came North and by their impassioned speeches aroused public sentiment. Garrison soon entered the contest and the American Anti-Slavery Society was formed. From the beginning women were prominently identified with this movement and the first Women's Anti-Slavery Convention was held in New York in 1837. The names of Lucretia Mott, Lydia Maria Child, Maria Weston Chapman, Abby Kelly, Abby Hopper Gibbons and many others soon became widely known. The whole question of human rights was thoroughly discussed and women then began to recognize their own and to take part in the business meetings and public debates of the society. This aroused violent opposition and in 1839 the society was rent in twain on this point. The half sustaining the rights of women comprised Garrison, Phillips, Pierpont, Pillsbury, Thompson, Foster, Stanton, Gerrit Smith — nearly all of those who eventually carried the abolition of slavery to success. Thenceforth these men became the champions of women's rights, including that of the ballot, and the women added to their appeals for the slaves others for their own legal and political liberty.

The question of woman's right to take public part in this movement was carried to the World's Anti-Slavery Convention in London, in June 1840, which refused to recognize the eight women delegates from the United States, who included Lucretia Mott and Mrs. Wendell Phillips. It was at this time that Mrs. Mott and Mrs. Stanton, a bride, whose husband, Henry B. Stanton, was a delegate, decided that on their return to the United States they would organize a movement especially for the rights of women. Mrs. Mott remained several months lecturing in England and Scotland and found considerable sentiment in favor of permitting women to vote, especially among the Friends, or Quakers. In 1847 Lucy Stone, recently graduated from Oberlin College, began speaking for the rights of women.

A wave of reform swept over Europe about the middle of the 19th century and reached the shores of the United States. It carried the desire for liberty of thought, speech and action and for the redress of wrongs to humanity. This nation was seething with the discussion of temperance and slavery. Such temperance laws as had existed had been repealed and there was no regulation of the liquor business. The question of slavery had become acute by the admission of Texas into the Union as a slave State and intensified by the Fugitive Slave Law. Women were as vitally interested in these questions as were men and they could no longer remain silent and inactive. Their first timid attempts at speaking in public and taking part in conventions were made in the temperance movement and here they met with a determined attempt by the men to suppress them. In the 'History of Woman Suffrage' may be found detailed accounts of the way they were literally silenced at temperance conventions, excluded from committees and forced to hold separate meetings. Their treatment by a part of the leaders in the anti-slavery movement has been referred to.

The Society of Friends, or Quakers, had divided on the slavery question and as this sect had always recognized equality of rights their women especially resented the discriminations that were being made. In 1848 during the yearly meeting of the liberal branch in Waterloo, N. Y., Elizabeth Cady Stanton went over from her home in the neighboring village of Seneca Falls to be with Lucretia Mott at the home of a mutual friend, Mary Ann McClintock. Mrs. Mott's sister, Martha C. Wright, came from Auburn. The four women talked over the situation and Mrs. Mott and Mrs. Stanton decided to put into effect the resolution they had made in London eight years before to call a convention for a public discussion of the rights of women. So here in the McClintock home on a Sunday morning in June these four issued a "Call" for the first woman's rights convention in all history and published it, unsigned, in a local paper. They then prepared a declaration of rights modeled after the Declaration of Independence and a set of resolutions which demanded practically every right that women are enjoying at the present day, including suffrage. The convention met in Seneca Falls, 19, 20 July, in the Wesleyan Methodist Church, and James Mott, of Philadelphia, the husband of Lucretia, and one of the most prominent Friends in the country, presided. As many as the church would hold were present; the declaration and resolutions were discussed and adopted, and here began the movement for woman suffrage which has continued without cessation.*

* Consult 'History of Woman Suffrage' (Vol. I, p. 67) for full account.

reached on far away ranches and in isolated mining camps. Montana cast 52 per cent of the whole vote in favor and Nevada 60 per cent.

When in 1914 the number of equal suffrage States had reached 11 and favorable public sentiment was rapidly increasing, the opposition concentrated its full force on every State where an amendment to its constitution was submitted and no further successes were recorded until there came the great victory in New York in 1917. Although the first movement for woman suffrage in the world had begun in this State in 1848 and never had ceased, and although it had been the first ever to have presented to its legislature a petition to submit an amendment to the voters, this request had been annually refused by every one beginning with that of 1854. The women at last became so strongly organized that by 1915 it could not longer be withheld, but it was defeated in November by 95,000. The women went directly to the legislatures of 1916 and 1917 and demanded its resubmission, which was granted in both, by votes not far from unanimous.

The suffragists then built up the largest State organization of women ever known, approximately half a million in New York City and an equal number in the rest of the State. Although they were immersed in the vast work of the European War they made a record campaign, one feature of which was the securing of a petition for the vote by 1,015,000 women in the State over 21 years of age. On 7 Nov. 1917, the amendment received 675,389 affirmative votes, later increased to 703,129 by those of the soldiers, who voted two to one in favor; 600,776 negative votes were cast; carried by 102,353.

The success in this influential State gave great prestige to the movement. Three more important victories quickly followed when, on 5 Nov. 1918, the electors of Michigan, South Dakota and Oklahoma enfranchised women. In Michigan the amendment received 229,790 ayes; 195,284 noes, a favorable majority of 34,506; in South Dakota it was adopted by 49,-213 ayes to 28,885 noes, a majority of 20,328. Oklahoma made the unparalleled record of carrying an amendment with the handicap of a constitutional requirement that it must receive not only a majority of the votes cast on it but a majority of the highest number cast at the election. On the amendment were cast 107,-000 ayes; 81,481 noes, a favorable majority of 25,528. The highest number of votes cast at the election was 194,435 for governor; the amendment received apparently a majority of 9,791 of the total, but this is probably an underestimate. It was one of the most remarkable victories ever achieved for woman suffrage. Each of these campaigns required a vast amount of money and work by the women.

Primary Suffrage.— As the constitution of Arkansas is difficult to amend, its legislature took advantage of the authority it had under the Primary Election Law and in 1917 granted to women the same vote as possessed by men at all primaries, including those for Presidential electors. This was the first State suffrage granted in the South and as there is practically but one party the primary is really the election. In 1918 the Texas legislature gave this same primary franchise to women.

Presidential Suffrage.— The Presidential election of 1916 aroused nation-wide interest in the question of votes for women, as it was generally accepted that it had been decided by the equal-suffrage States. The injustice was widely recognized of permitting the women of one section of the country to help choose the President of the United States and denying this privilege to those of other sections, so the National Association decided that the time was ripe for pushing its long-cherished plan to obtain so-called Presidential suffrage for women. The Federal Constitution empowers every legislature to determine the manner in which the Presidential electors of the State shall be chosen and it is the universal custom to have this done by popular vote. In many States when the legislatures assembled in January 1917 they found themselves confronted by a request from the women that a law should be enacted giving them the right to vote for these Presidential electors, which could be done by a simple majority of the legislatures. They had granted this in Illinois in 1913; the women had voted at the election of 1916 and their votes had been accepted in the Electoral College without question.

By April this Presidential vote had been conferred by the legislatures of North Dakota, Nebraska, Indiana, Ohio, Michigan and Rhode Island. The first three added municipal and county suffrage as Illinois had done. The Vermont legislature in March passed a bill giving only municipal suffrage to women. Tennessee included it with Presidential suffrage in 1919.

The Supreme Court of Indiana declared that the legislature could not constitutionally grant the municipal and county franchise and as the Presidential was included in the law it also was ruled out. Ohio by means of an initiative petition, which was clearly unconstitutional, submitted the law to the voters and they defeated it. The same attempt was made in Nebraska, but the court found the petitions so fraudulent that it refused to permit a referendum and declared the law to be in effect. Michigan nullified it by giving full suffrage. In the winter of 1919 the legislature of Indiana reenacted the law for Presidential suffrage and it was granted during the winter and spring by the legislatures of Vermont, Wisconsin, Maine, Minnesota, Missouri, Tennessee, Iowa and in July again by Ohio.

The women of 30 States, two less than two-thirds, now have the right to vote for 330 of the 531 Presidential electors. Sixty senators and 154 representatives are elected partly by votes of women. The number of women 21 years of age in the States where they have Presidential suffrage only is estimated at 8,000,000. There are approximately 7,500,000 women of voting age in the 15 equal-suffrage States. The total number of women of this age in the entire United States is about 27,000,000.

All the suffrage now possessed by the women of the United States has been gained through the efforts of the National American Association and its State branches, by strictly nonpartisan, constitutional methods.

Not in any State has the legislature power to confer the full suffrage on women, but this must be done by amending State constitutions.

which requires submission to the voters. The legislatures can grant the above-mentioned franchises and also a fragmentary vote, varying in different States, on school matters, issuing of bonds, special taxation, etc., which has been done by over half of them.

Although the National American Association has done so large a work in obtaining woman suffrage in the States it has regarded this as but preliminary to securing a Federal amendment, as a means for bringing pressure on Congress. From 1869 it paused only long enough to have a thorough test made of women's right to vote under the 14th Amendment. In 1871-72 women tried to vote in various parts of the country, Susan B. Anthony among them. She was arrested, tried and fined. Mrs. Virginia L. Minor, of Saint Louis, was refused registration and carried her case to the United States Supreme Court (Minor v. Happersett).* An adverse decision was rendered in 1875 and the association then returned to its original object. Hearings before committees of Senate and House were held from 1869. Senator A. A. Sargent, of California, presented in 1878 the amendment which thereafter was introduced into every Congress: "The right of citizens of the United States to vote shall not be denied or abridged by the United States or by any State on account of sex." The appeals and arguments of the women were treated by the committees in a purely academic spirit and it was difficult to get any kind of a report. From 1878 to 1896 there were six favorable majority reports from Senate committees and two from House committees and four adverse. Thereafter none of any kind was made until 1913—after the victories in Kansas, Arizona and Oregon.

The movement for woman suffrage at this time entered upon a new era and began to be regarded seriously by politicians. Only once had the amendment been brought to a vote in the Senate—25 Jan. 1887, through the efforts of Senator Henry W. Blair, of New Hampshire—and the vote resulted in 16 ayes, all Republicans; 34 noes, 11 Republicans and 23 Democrats, with 26 absent. The second vote was taken 19 March 1914; ayes, 35; noes, 34, lacking 11 of the necessary two-thirds majority. One Progressive, 14 Democrats and 20 Republicans voted aye; 22 Democrats and 12 Republicans voted no.

A Federal amendment for woman suffrage had never been discussed in the House of Representatives. After a long contest it was finally reported and brought to a vote 12 Jan. 1915. The debate lasted 10 hours and the vote stood 174 ayes, 86 Democrats, 75 Republicans, 12 Progressives, 1 Independent; 204 noes, 33 Republicans and 171 Democrats.

In 1916 a nation-wide campaign was made to obtain from the Presidential nominating conventions an endorsement of the Federal Suffrage Amendment, an effort which had been made unsuccessfully every four years since 1872. Dr. Anna Howard Shaw, honorary president, and Mrs. Carrie Chapman Catt, president of the National Association, were present at the Republican Convention in Chicago and the Democratic in Saint Louis, with many other women leaders. Both conventions failed to endorse the amendment but put a plank in the platforms declaring in favor of woman suffrage by action of the States. It had long found a place in those of the minority parties and received a strong impetus from its advocacy by the Progressive party in 1912.

The first of December the National American Association opened large, handsome branch headquarters in Washington for the special work of getting the Federal amendment through Congress. It was here that the Association's Council of One Hundred was summoned by Mrs. Catt to meet 23, 24 Feb. 1917 when the entrance of the United States into the European War seemed at hand and pledged to the government the services of the association with its millions of members. The following April Dr. Shaw was selected by President Wilson and the Council of National Defense as chairman of the Women's Committee to organize and direct the war work of the women of the nation.

A Federal Woman's Equality Association was organized in 1890 with the Rev. Olympia Brown, president, and Mrs. Clara Bewick Colby, corresponding secretary. It held that Congress, by a majority vote of both houses, could empower women to vote in all elections for members of the House of Representatives, and for United States Senators after the National Constitution provided that they should be elected by popular vote. It had many hearings before committees of Congress but the question was never brought before either house. Mrs. Belva A. Lockwood, of the District of Columbia, and Miss Laura Clay and Mrs. Sallie Clay Bennett, of Kentucky, were among the prominent women who supported this measure.

An organization formed in 1913 called first the Congressional Union and later the National Woman's party, also had headquarters in Washington to work for the amendment and used partisan, militant methods, "picketed" the White House, burned President Wilson's speeches, etc.

It was exceedingly difficult to get a report even "without recommendation" from the Judiciary Committee of the lower House, to which the measure was always referred, and the effort frequently made to secure a committee on woman suffrage, such as existed in the Senate, finally succeeded in September 1917. Both Democrats and Republicans now admitted that a Federal Amendment was inevitable and the opponents realized that all they could hope for was to postpone it as long as possible. After much opposition the measure was put on the calendar for 10 Jan. 1918. The evening before the vote was to be taken President Wilson urged his party to support it. After a long discussion the vote stood 274 ayes, 136 noes; Republicans, 165 for, 33 against; Democrats, 104 for, 102 against; 2 Independents, 1 Progressive, 1 Socialist, 1 Prohibitionist for; 1 Progressive (Louisiana) against. The amendment received one more than the two-thirds necessary to carry it, but Speaker Champ Clark (Democrat), of Missouri, had promised to vote in favor if there should be a tie. Fifty-six of the affirmative votes were from Southern States.

The contest was now carried into the Senate. The committee unanimously reported it and in a short time promises were secured for the needed two-thirds, lacking only three or four. Then occured an unprecedented misfortune in

* Consult 'History of Woman Suffrage' (Vol. II, p. 734).

the death of 10 senators, seven of them pledged to vote for the amendment. Former President Roosevelt and many other eminent men urged its adoption. Prominent senators in both parties worked for it and against it and at last it was decided to have a vote on 1 October. On 30 September President Wilson went in person to the Senate and made an eloquent appeal for the amendment in the name of true democracy. The vote stood 62 to 34, lacking two votes of the necessary two-thirds majority. His own party polled 57 per cent of its membership in opposition and the Republican 27 per cent. Of the 62 senators who voted or were paired in favor 32 were Republicans, 30 Democrats; of the 34 voting or paired in opposition 12 were Republicans and 22 Democrats.

Later the amendment was again placed on the calendar and 10 Feb. 1919 was set for another vote. President Wilson cabled from Paris to a number of senators and William Jennings Bryan came to Washington to intercede for it but all pressure was in vain. There was no change in the preceding vote except that William P. Pollock (Democrat), of South Carolina, chosen at a special election to fill out the term of Senator Tillman, voted in favor. The amendment, therefore, was lost by only one vote.

Both political parties would have considered it a calamity not to be able to have a vote on the Federal Woman Suffrage amendment until the regular session in December 1919. President Wilson relieved their anxiety by calling a special session of the newly-elected Congress to meet 19 May. The amendment was introduced by six members on the opening day and on the 20th was favorably reported by the committee and placed on the calendar for the next day, even before the President's message was read, in which it was recommended. On 21 May, after two hours' discussion, it was passed by 42 more than the needed two-thirds. The vote stood 304 ayes, 200 Republicans, 102 Democrats, 1 Prohibitionist, 1 Independent; 89 noes, 19 Republicans, 70 Democrats. Members from Southern States cast 71 of the affirmative votes. The Democrats polled 54 per cent of their voting strength for the amendment and the Republicans 84 per cent.

The Federal Suffrage amendment was introduced in the Senate 23 May by four members and placed on the calendar for 3 June. The opponents consumed two sessions in discussion. Amendments of various kinds were defeated. The roll was called at 5 P. M. 4 June and the vote was announced, 56 ayes, 25 noes. With the "pairs" that had been arranged the entire 96 members of the Senate were recorded and they stood; Republicans, ayes, 40; Democrats, 26; Republicans, noes, 9; Democrats, 21; total, 66 ayes, 30 noes.

Before this Federal amendment could become effective it would have to be ratified by the legislatures of 36 States, three-fourths of the whole number. The large majority of them meet biennially, in the uneven years and had adjourned before 4 June, but several were still in session and of these Illinois, Wisconsin and Michigan ratified in a few days; Pennsylvania and Massachusetts a little later. Mrs. Catt, president of the National Association, at once began telegraphing to the governors of many States a request that they would call special sessions for the purpose of ratification, and other influential suffragists exerted pressure. This was favored by leaders in both political parties in order that it might be completed in time for the women of the entire country to vote in the general elections of 1920. Gov. Alfred E. Smith, of New York, and Gov. Henry Allen, of Kansas, were the first to call special sessions and they were quickly followed by others.

The ratifications in a number of the States were unanimous in one or both Houses; in the others the favorable vote was very large. The dates of ratification were as follows: Illinois, Wisconsin, Michigan, 10 June; Ohio, Kansas, New York, 16 June; Pennsylvania, 19–24 June; Massachusetts, 19–25 June; Texas, 24–28 June; Iowa, 2 July; Missouri, 3 July; Arkansas, 28 July; Montana, 30 July; Nebraska, 1 August; Minnesota, 8 September; New Hampshire, 9–10 September; Utah, 29–30 September; California, 1 November; Maine, 4–5 November; North Dakota, 26 November and 1 December; South Dakota, 4 December; Colorado, 10 December, in 1920: Rhode Island, 6 January; Kentucky, 6 January; Oregon, 13 January; Indiana, 16 January; Wyoming, 27 January; Oklahoma, 25–28 February; West Virginia, 3–10 March; Washington, 22 March.

There is strong probability that 36 ratifications will be obtained and the Secretary of State will declare the amendment a part of the National Constitution before November 1920 when the general election takes place. This will give universal suffrage to the women of the United States on the same terms as exercised by men and eligibility to all offices.

In Other Countries.— The suffrage movements in the United States and Great Britain have run in parallel lines since their beginning in each country about 1832. The Worcester (Mass.) convention of 1850 was reported in the New York *Tribune* and attracted the attention of Mrs. John Stuart Mill who wrote an article about it which appeared in the *Westminster Review* in 1851. That year Mr. Mill began his powerful writing on the subject. When a member of Parliament he proposed it in an amendment to the Reform Bill of 1867 and presented a petition of 1,499 names headed by Harriet Martineau, Florence Nightingale, Frances Power Cobbe, Josephine Butler and Mary Somerville. It was lost by 73 to 196. The women then organized societies in Edinburgh, Bristol, Birmingham, Manchester and London, and later a National Association was formed, including Ireland. As president of the London branch, Mrs. Henry Fawcett began her 52 years of continuous service in this cause. In 1869 the Parliament granted the municipal franchise to women taxpayers. Jacob Bright introduced the first separate bill for woman suffrage in 1870 but its progress was blocked by the government. There was a good prospect that women would be included in the Reform Bill of 1884, which enfranchised agricultural laborers, but they were kept out by the efforts of Gladstone.

From 1866 the movement for woman suffrage in Great Britain and Ireland never ceased and it was supported always by the most eminent men and women. Petitions for it were signed by hundreds of thousands. After 1886 there was always a majority in favor

of it in the House of Commons but the government, whether Liberal or Conservative, systematically prevented the bills from reaching a final vote. While many minor objections were made, the fundamental reason for the defeats was the fear of each party that it might lose and the other gain by the enfranchisement of women. Through the years there were collateral gains, as in the United States. The laws relating to wives and mothers were improved; local franchises were given to women; a vote and eligibility for school boards; municipal suffrage; a vote for county councils; they were admitted to various official positions; the universities were opened to them. In 1907 they were made eligible as mayors and members of city and county councils.

In the early '90's Mrs. Emmeline Pankhurst and her daughter Christabel organized a revolt in which many women joined. Their society, the Women's Social and Political Union, adopted militant methods, which grew more violent as their treatment by the government became more rigorous, but not the slightest progress was made in obtaining woman suffrage from the Parliament. The opponents simply had an excuse for their opposition which did not exist before. The situation was at its worst when the European War broke out in 1914. The Women's Social Political Union closed its headquarters and disintegrated, Mrs. Pankhurst personally devoting herself to the recruiting of soldiers. The old National Association, of which Mrs. Fawcett had for many years been president, immediately placed its large equipment and well-trained forces at the service of the government and carried on for four and a half years what was probably the largest organized work of women during the war. By the autumn of 1916, the long-time demand for a reform in the franchise laws could no longer be deferred and a conference of members of Parliament from all parties was appointed to prepare the new measure. There was scarcely a question as to the inclusion of women. Prime Minister Asquith, who had been their most powerful opponent, sanctioned and promoted it. Lloyd George urged it. The conference reported in February 1917, and the Representation of the People's Bill conferred the complete franchise on all women who were on the local government list; on the wives of all men who were on this list and on all women holding a university degree, but they must be 30 years old. This includes Ireland. The reason given for fixing this age was that 2,000,000 men voters would be added to the electorate and the addition of 7,000,000 women was all that could be undertaken. This was very unsatisfactory to the suffragists but they accepted it as an ultimatum at that time.

There were many Parliamentary delays and it was not until December that the bill came before the House of Commons for final reading. The suffrage clause was carried by a vote of more than two to one and the bill sent to the House of Lords. Here also it passed by two to one; the final vote was taken 6 Feb. 1918, and it immediately received the signature of King George. Men can vote at 21 and women also at all local elections, and they are now making a vigorous effort to have the age limit for the Parliamentary vote removed.

In granting the franchise to women Great Britain followed all her colonies except India and South Africa. The South African Parliament in 1919 voted its approval of woman suffrage and is likely soon to enact a law for it. There is a considerable demand for it among the educated women of India. In New Zealand, Australia and Canada women had the school and municipal franchise at an early date. The Parliament of New Zealand gave the complete suffrage in 1893; that of South Australia in 1895; of West Australia in 1900. In 1901 the six states federated and in June 1902, the National Parliament gave the women of the entire commonwealth the vote and eligibility for that body. The Parliament of New South Wales granted the state suffrage in 1902; that of Tasmania in 1903; that of Queensland in 1905 and that of Victoria in 1908.

There had long been a movement in Canada for the full enfranchisement of women, led at first by the National Suffrage Association and later also by the National Council of Women. The patriotism and efficiency of the women during the European War increased public sentiment in its favor and accelerated the action of the state governments. Full suffrage was granted by the legislatures of Manitoba, Alberta, Saskatchewan, and by popular vote in British Columbia, in 1916; by the legislatures of Ontario in 1917; of Nova Scotia and New Brunswick in 1918; by the council of the Yukon in 1919. Quebec and Prince Edward Island have not given the state suffrage. In 1918 the Dominion Parliament conferred the national suffrage on all women. The bill contained some war time provisions which it is now thought best to remove. The government has introduced a bill codifying all the franchise laws (1919). Women suffrage will undoubtedly be retained.

At the beginning of the present century, there was very little suffrage for women anywhere in the world outside of the United States and Great Britain and her colonies. In various parts of Europe women property-holders could vote by male proxy at local elections and in a few countries at Parliamentary elections. In Russia, among the peasant classes, women voted almost as freely as men at village elections, either as owner of property or proxy for the husband. Sweden in 1862 gave women ratepayers a vote for all officials except members of Parliament — more than women possessed anywhere else in the world at that time. Widows and spinsters in Finland had local voting rights in 1865. Iceland gave women taxpayers the municipal vote in 1882. The ancient little kingdom of the Isle of Man, with its independent government and its laws requiring only the sanction of the ruler of Great Britain, gave full suffrage to women property-owners in 1880 and to women ratepayers in 1892.

In 1906 the newly-formed government of Finland gave equal and universal woman suffrage. In 1901 Norway gave the municipal and in 1907 the full suffrage to women with a very small taxpaying qualification, which in 1913 was entirely removed. In 1913 Iceland gave the full suffrage. Denmark granted the municipal franchise in 1907 and adopted a new constitution with universal and equal suffrage in 1915.

she was Supreme Record Keeper, which office she held until July 1911, when she became Supreme Commander. She personally introduced the Association in the original 16 States of its jurisdiction, revised and developed its ritualistic work, assisted in combining the separate State jurisdictions under one central government, and instituted and perfected the system of general management. The success of the Order has been due primarily to the efforts and executive ability of this great leader. Miss West was born in Saint Clair County, Mich., the daughter of Alfred J. and Elizabeth Conant West, a direct descendant of Roger Conant, first governor of the Massachusetts Colony. She first became identified in 1890 with the woman's auxiliary to the Maccabee Order, then organized in Michigan, and in 1891 was so successful as State Organizer that she was elected Great Lieutenant-Commander (corresponding to vice-president) for Michigan and was thereby a member of the executive committee and concerned with the management and growth of that branch of the Association. In 1892, mainly through her efforts, a national body called "The Supreme Hive of the Ladies of the Maccabees of the World" was established with a view to combining under one central organization the separate groups of women then doing business in the various States under the name of "Ladies of the Maccabees," and of carrying the Order into still other States. Miss West was thus the founder and has been the real manager and leader of the Association since its inception. Her unselfish and indefatigable services to the Association and her wonderful qualities of leadership have made it the greatest fraternal benefit society composed and officered solely by women. Every one of the certificates in force, amounting to $155,404,138.26, bears Miss West's signature, and she has with her own hand signed warrants disbursing over $18,500,000 in benefits.

History.— The Woman's Benefit Association was established on 1 Oct. 1892, being organized to provide a central government for reviews already established in Michigan, New York and Ohio (The Michigan branch, however, never affiliated completely with the Supreme Body and continued a separate organization, thus permitting the Woman's Benefit Association to enter Michigan the same as in other States. The Order in Ohio came under Supreme jurisdiction in 1898 and that of New York in 1899). The first review in New York was organized at Grand Island, 11 March 1891; in Ohio at Cleveland, 15 July 1892. The first review organized directly under the jurisdiction of the National body was at Pittsburgh, Pa., 7 Oct. 1892.

During the first two years of the Association's existence 203 reviews were organized in 18 States. Of these 55 were organized by Miss West's personal efforts. The total of reviews now number 2,555. The growth of the Order has been rapid and steady and its membership has grown in 27 years to 216,290, making it the largest fraternal benefit society in the world conducted wholly by women and for women. The Association is also one of the strongest financially in the fraternal world, having reserves on hand of over $12,000,000 carefully invested in municipal bonds, the interest alone on these bonds amounting annually to more than $550,000.

Government.— The government is purely representative, every member in the Association having a share in its management through the election of delegates to State and National conventions. The National Convention is called the Supreme Review and is held once in four years for the purpose of enacting laws, electing officers and transacting any other necessary business of the Association. In the interim between meetings of the Supreme Review the Association is managed by the Supreme Board of Trustees, consisting of the Supreme Commander (president), Supreme Record-Keeper (secretary) and three other members elected by the Supreme Review. Each State has State supervision and the local reviews are conducted with a full set of officers and handle their own business direct with the headquarters of the Association at Port Huron, Mich.

The Association was first incorporated on 6 March 1897 and is an independent corporation, making its own laws, transacting its own business, collecting rates and paying benefits according to its laws. The sums collected and paid out in the 27 years of the Order's existence amount to $18,500,000 and not one dollar has ever been lost through unwise investment or defalcation, or in any other way, and receipted bills are now on file carefully audited by the Board of Supreme Auditors for every penny that has been expended. Annual reports of all business transacted are made to State insurance departments and the Association has since 1904 made annual valuation of its certificates to determine its exact condition and reserves for paying promised benefits.

Headquarters.— The Association was established in Port Huron, Mich., in 1892 and still maintains its headquarters there. It has in the best section of that city a Home Office Building which cost $250,000 and which is one of the most modern and best equipped office buildings in the country. It is two stories high, of stone and reinforced concrete, and is fireproof throughout, with every provision for carrying on the immense volume of the Order's business, for the comfort of its office force of 100 young women and with private offices and meeting rooms for the Supreme Boards of the Association. It has rooms also for the use of local reviews in the city.

Social and Welfare Work.— The Woman's Benefit Association, besides providing death benefits at cost for the protection of home and little ones, gives burial benefits and benefits for members totally disabled. More than this, it provides by general contribution a fund from which hospital service and medical care are given free to needy members. Contracts are in force between the Association and 84 hospitals located in all the large centres of membership in which this free service is given. Since its establishment in August 1915, 5,719 suffering members have been cared for in this way, who would otherwise have been unable to secure the necessary medical attention.

Auxiliary to the Woman's Benefit Association is "The Order of the Rose," a society for girls up to 16 years of age. The ritual of this Order is most inspiring, and through its courts,

the parenchyma, such as endometritis and metritis of the neck or body of the uterus; to ulceration of the os and cervix uteri, and to displacement (prolapsus or falling of the womb), versions and flexions. The causes of endometritis are direct injuries (as from pessaries, chemical irritants, etc.), inflammation of the vagina, interference with the menstrual flow, etc.; of metritis, mechanical and other injuries, sudden suppression of the menstrual flow, endometritis and morbid growths. Ulceration is usually a complication of endometritis. Among the causes are uterine displacements causing friction against the cervix, abuse of sexual intercourse, vaginal or uterine leucorrhœa, the use of pessaries, and injuries in parturition. Displacements of the uterus are quite common and among their causes are: (1) increase in weight of the uterus from inflammation or congestion, tumors, pregnancy, fluid retained in the cavity, etc.; (2) weakening of the uterine supports from rupture of the perinæum, loss of tone of vaginal walls, laxity of uterine ligaments and degeneration of uterine tissue; (3) influences pressing the uterus out of place, such as tight clothing at the waist, the weight of heavy clothing on the abdomen, muscular efforts, such as lifting and straining, abdominal tumors, distended bladder, etc.; (4) traction on the uterus, from deposits of lymph in pelvic areolar tissue, cicatrices in vaginal walls, shortening of uterine ligaments, etc. Flexions of the uterus are bendings of it forward, backward, or to either side, known as anteversion, retroversion, etc. A prolapsus is a falling or descent of the uterus into the pelvic cavity, or the prolapsed organ may protrude from the body at the vulvar orifice. The first form is known as incomplete prolapsus, the latter as complete prolapsus. The symptoms of uterine diseases include leucorrhœa, pain in the small of the back, dragging sensations, a feeling of weight and heaviness, interference with the functions of the bladder and rectum, dyspepsia and despondency. See EMBRYOLOGY; MENSTRUATION; OBSTETRICS; OVARY; and consult Kelly and Noble, 'Gynecology and Abdominal Surgery' (Philadelphia 1916).

WOMBAT, a burrowing marsupial of the phalanger family and genus *Phascolomys*, natives of Australia and Tasmania. The species most commonly known (*P. wombat*) is two to three feet long, with a very short tail, clumsy form, stout limbs, blunt muzzle and rough hair of variable tint. In their general form and actions the wombats resemble small bears, having a similar shuffling plantigrade walk; but they are even shorter in the legs and broader in the back than those animals. The dentition resembles that of rodents. They live on the ground and in burrows or holes among rocks, feeding on roots, grass and other vegetable substances. They sleep in the day, seeking their food at night, and are usually gentle in their habits, though their large chisel-like incisors enable them to bite strongly if provoked. Wombats exhibit small intelligence, but are gentle, and capable of domestication to a limited extent. They are hunted for their flesh, which is highly esteemed, and is said to resemble pork. Several species exist, besides the one above mentioned. *P. ursinus* is brownish gray, like the third species, the hairy-nosed wombat (*P. latifrons*), which differs from the other two in having smooth silky fur, a hairy muzzle, and large pointed ears. It inhabits southern Australia. The largest living wombat (*P. platyrhinus*) is about three feet long, but remains of a large extinct genus (*Phascolonus*), which must have been nearly as large as a tapir, have been found in Queensland. Consult authorities mentioned under MARSUPIALS.

WOMBWELL, woom'wĕl, England, a town in the West Riding of Yorkshire, about five miles southeast of Barnsley, with extensive coal mines in the neighborhood. Pop. 17,536.

WOMEN, Education of. See EDUCATION OF WOMEN.

WOMEN, Legal Rights of. During the earliest times of which we have records, the legal rights of women were narrowly circumscribed. By the Mosaic law the rights of the wife were quite subordinate to those of the husband, and daughters could inherit only where there were no sons. Under early Roman law (3d century B.C. and later), the husband could condemn his wife to death for adultery and without public trial. Owing to abuses the law later took away the power of the husband to condemn his wife to death, but provided that the father might put to death a daughter taken in adultery, with the important proviso that her paramour be killed at the same time. Usually a daughter could be forced into marriage by the father, while he had no such power over a son. However, with the rise of Christianity the rigor of the law in relation to women was greatly abated, and in certain particulars they were shown more leniency than men. For instance, ignorance of the law if the offense did not involve good morals was accepted as a valid defense for women because of the weakness of the sex. Further, a wife could not be convicted in a criminal action for theft from her husband — a provision which persists in a slightly modified form in the law of the United States and other countries to the present day. The power of initiative in divorce — previously held by the husband only — became the privilege also of the wife and she was empowered to send her husband a divorce whenever the circumstances warranted such action. Women, whether married, unmarried, or widowed, could legally dispose of property by will the same as men, and daughters were allowed to inherit equally with sons. In ancient Greece, the legal rights of women were subordinate to the men as in the early Roman law. The Germanic and other laws of this period were in many particulars equally severe. From an early date in England unmarried women could legally make a contract or a will, could sue or be sued, and needed no guardian as in Roman law. Formerly in England criminal laws against women were very severe and rigorously enforced, death being the penalty for bigamy and manslaughter and even for larceny. One anomaly of the English law to-day working to the prejudice of women is that which provides that a husband may obtain a divorce on proving infidelity on the part of his wife, but which denies her a divorce on proving his infidelity unless she further

proves his commission of one of certain other enumerated serious offenses. Mild chastisement of a wife by a husband, however, once sanctioned by law, is now prohibited. In 1885 by the Criminal Law Amendment Act, the age of consent of females in England was raised to 16, thus eliminating an abuse of long standing. The right of primogeniture, now almost totally superseded on the Continent, in the English-speaking British Colonies, and in the United States, still persists in the law of the United Kingdom and works hardship to female heirs. The law of Scotland is in most respects similar to that of England, but testamentary capacity is given to females by Scotch law at a much earlier age than by English law. In many of the Eastern countries even to-day the law has made very few advances from olden times, and women are almost universally treated as the inferior of men, with only slight indications of any amelioration of this deplorable condition.

In the early history of the United States women suffered from the rigor of the law. As late as toward the close of the 17th century women were refused any rights to an education, were punished for speaking in public, and occasionally old women were burned as witches. It was not until a century later that women were given the right to a few months' education a year in primary schools, and not until 1819 did the government give any systematic financial aid toward the education of women. Statutory modifications of the severities of the common law with regard to married women began in the United States in 1848, New York taking the initiative. The other States followed rapidly, and within a comparatively short time most of the legal disabilities of married women were swept away. (See CURTESY; DOWER; HUSBAND AND WIFE). Under the Constitution of the United States or at the common law women have no legal right to practise law. By statute, however, they may now do so in the Supreme Court of the United States, and also in the highest courts of nearly all the States. It has been held in a number of State courts, in the absence of statutory or constitutional provisions to the contrary, that women may practise law in the entire absence of statutes authorizing it. Other decisions, however, hold to the contrary. By statute some States provide that no persons shall be precluded from practising any profession or employment (except military) by reason of sex; others by legislation or by constitutional restriction provide that women shall not be permitted to work in certain industries, as coal mining, a regulation manifestly for their own protection. By statute in a number of States, a married woman may act as a guardian, administratrix, or executrix. Up to 1915 a large majority of the States regulated by law the hours which women were permitted to labor in most industries, usually 8 to 10 hours a day, with restrictions on night work. Minimum wage laws for women have been passed in a number of States, and these have been held constitutional by the Supreme Court. (See LABOR LEGISLATION) During the early history of the United States the age of consent of females was nearly everywhere deplorably low, but legislation has raised this age so that in many States it is now (1919) 18 years, with a general average of about 16. In the case of wills of personal property, testamentary capacity in the various States is often fixed at a lower age for females than for males. For example, in New York State the age for females is 16 years while it is 18 for males. (See TESTAMENT). In 1911 the first widows' pension law was passed (Missouri) and within eight years more than half of the remaining States had adopted this form of remedial legislation. (See PENSIONS). In a number of States to-day statutes expressly exempt women from arrest in all civil actions. The rigor of the early criminal law in the United States in its treatment of women has almost entirely disappeared. The tendency is decidedly toward leniency. With the recent extension of the franchise to women, the favorable indications for even wider extension soon, and the corresponding increase in their political power, together with the growing number of women legislators, it is safe to predict that women will add considerably in the near future to the legal advantages they have already secured. See WOMAN SUFFRAGE.

EDWARD F. DONOVAN.

WOMEN, Medical Education of. See MEDICAL EDUCATION IN THE UNITED STATES.

WOMEN IN INDUSTRY. Through all the variations and complexities of modern industry there runs the simple motive of primitive human activity, viz., the need of food, clothing, housing and ethical expression. In such activity women have always had a part, though that part has varied with countries and with centuries.

In the United States, before the development of modern industry, women were concerned chiefly with the preparation of food and clothing. Women practically monopolized the spinning of cotton and woolen yarns, the making of hosiery, the manufacture of women's clothing; they made all the bread and pastries, and were the nation's canners. With men, women shared the weaving of cotton before the development of modern industry, the manufacture of men's clothing and the slaughtering and curing of meats.

During this period in America's history men were the chief makers of boots and shoes and the principal weavers of wool. They were almost exclusively concerned with the manufacture of flour and grist-mill products, wood and wood products, clay, glass and stone manufactures, and in the production of fuels.

There are no statistics showing the exact number of men and women that were engaged in the home occupations, but the compilations made by such men as Alexander Hamilton, Tench Coxe and by other early American historians, together with many State documents, afford ample evidence that although there were some interesting exceptions, broadly speaking the work of providing food, clothing and housing was divided in the manner described between men and women before the development of modern factory system.

Although the industrial eras, referred to as "before" and "after" the development of modern industry, are not abruptly demarked, but merge almost imperceptibly one into the other, there is no difficulty in determining the periods if a transition zone of sufficient width is marked off between the old and new orders in each industry or group of industries. For example, the first stocking mills of any im-

portance were established in the United States about 1820. Before this time, and for a goodly time afterward, hosiery was a household manufacture in the hands of women. They held their own in spite of the factory until the application of power to the looms in 1832. This and later inventions put wings to the factory industry. Forty years after the introduction of the power loom, stockings were practically a factory product, and women, who monopolized the work when it was a home industry, constituted about 55 per cent of the employees in the hosiery mills of 1870. The transition period covers about 40 years, but there is no question now about the complete monopolization of the mills, factories and mechanical establishments, and the immense field of employment dependent upon these industries, viz., the wholesale and retail stores and other distributing agencies and offices. Twelve million women, however, are the approximate total number of women earning their own living in part or in whole, usually by wage-payments or profits from independent business or services. They include domestic servants and women who go from house to house to sew, to wash, to clean; they include teachers and actresses, doctors and nurses and lawyers and women in independent business. They include women working their own farms and women helping on their own or

TABLE I.

COMPARISON OF NUMBER AND PER CENT OF INCREASE OVER 1870 OF BREAD-WINNING WOMEN, WITH TOTAL FEMALE POPULATION 10 YEARS OF AGE AND OVER, AND COMPARISON OF THEIR INCREASE IN INDUSTRIES, PROFESSIONS AND OTHER OCCUPATIONS IN SPECIFIED DECENNIAL YEARS.

YEAR	Female population		Bread-winning women		Increase of bread-winning women in:							
					Manufactures, mechanical and mining pursuits		Stores and offices		Professions		Domestic and personal pursuits, agriculture	
	Number	Per cent increase over 1870	Number	Per cent increase over 1870	Number	Per cent increase over 1870	Number	Per cent increase over 1870	Number	Per cent increase over 1870	Number	Per cent increase over 1870
1870.	13,970,079	.....	1,836,288	.....	354,021	.....	20,383	.....	92,054	.....	1,369,830	.....
1880.	18,025,627	29.0	2,647,157	44.2	631,034	78.3	63,058	209.4	177,255	92.5	1,775,810	29.7
1890.	23,060,900	65.1	4,005,532	118.1	1,027,928	189.0	228,421	1020.6	311,687	238.6	2,438,248	77.9
1900.	28,246,384	102.2	5,319,397	189.7	1,312,668	270.8	503,347	2369.4	430,597	367.7	3,072,785	124.4
1910.	34,552,712	147.3	8,075,772	339.8	1,767,131	399.1	1,202,352	5798.8	754,890	720.0	4,351,399	217.6

The industrial classifications adopted by the census vary widely in the successive decennial years. For the purpose of comparison, however, the 1900 census of occupations made the necessary rearrangement for the three previous decennial years, and these have been used in the accompanying table. The classifications for 1910 used in the table are those adopted by the 1900 census. In some minor occupations the figures did not permit of the necessary rearrangement. If they had, however, the trend shown in the table would have been accentuated.

To the policy of adopting the 1900 census classification wherever the figures would permit, two exceptions were made, the most important being that of trained nurses who were classed with "Domestic and Personal Service" in 1900 and with "Professions" in 1910. The figures would permit the transfer of the 76,000 trained nurses back to the domestic and personal service column and the 5,000 women photographers to the group of manufacturing industries. Such a change would reduce the group representing women in professions from 9.1 per cent of all bread-winning women, as shown on the table, to approximately 8.1 per cent. But this reduction would be at least partially offset by the changes referred to which could not be made and which would have increased the per cent in the professional group. Trained nurses were left among the professions because the increasing requirements have, during the last 20 years, raised the whole occupation from the level of domestic and personal service to that of a profession. This was true, perhaps, in large measure in 1900, but the census of that year specified "nurses, trained and untrained" without giving the figures separately. Since trained nursing has become a recognised profession, the number of women reported therein were left in the professional group. The claim of the photographers may not be quite so clear. They certainly seem, however, to belong more properly among professions in view of the artistic requirements of modern photography, than among the group of women in manufacturing industries, where they were in the 1900 census. The number of women photographers involved, however, would change the percentages but a small fraction of one per cent. Therefore, the 1910 classification of trained nurses and photographers, as belonging to the professional group, was accepted, though transferring them to the 1900 classifications would not materially affect the trend shown by the table.

manufacture by the factories, nor about its being a home industry and in the hands of the women at least before 1820.

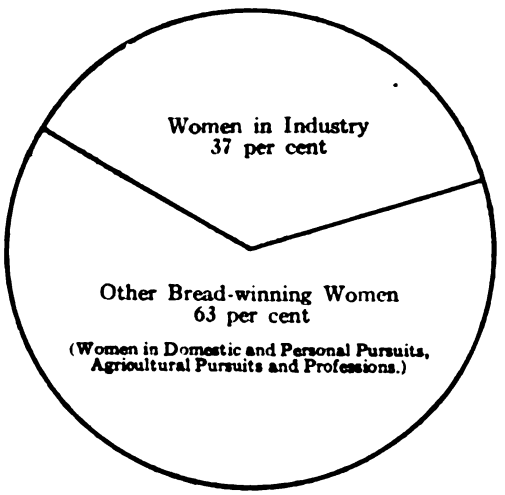
The World War effected at least a temporary revival of home knitting. The relative importance of the home product, however, was not significant even in war time, as it is not probable that the home knitter will become a serious peace time competitor of the factory knitter.

Before discussing in detail the entrance of women into industry, it is necessary to clear away any misconception which may cloud the meaning of the term "women in industry" as used here. It is not uncommon to hear about the "twelve million women in industry." This entire army of women workers is commonly, and erroneously, supposed to have "invaded" others' farms without wages or payment in kind. Such women are not usually thought of as "women in industry" and many of them are obviously not properly described by the term.

Just what proportion the women in stores, mills and factories — or the women usually in mind when the term "women in industry" is used — are of the whole number of bread-winning women is best shown by the circle on the following page, which has been divided to illustrate the relative proportion of "women in industry" and other "bread-winning women" according to the occupation census of 1910.

This circle throws into bold relief the fact that of the millions of women who are earning their own bread, scarcely 37 per cent are earning it in stores, mills, factories and other mechanical establishments or in offices. These

women have "invaded" the great domain of modern industry. The other 63 per cent are earning their living in the professions, in agriculture, and in domestic service, or they are winning their bread as waitresses, boarding and lodging-house keepers, nurse maids, etc.


Women in Industry
37 per cent
Other Bread-winning Women
63 per cent
(Women in Domestic and Personal Pursuits, Agricultural Pursuits and Professions.)

While bread-winners in all pursuits as compared with the total female population 10 years of age and over have been steadily increasing during the last half century, the rate of increase in the proportion of women entering factories, mills and stores since 1870 is much greater than the rate of increase in the proportion of women entering all bread-winning pursuits. This is clearly seen in Table I.

Women in Manufacturing and Mechanical Industries.— Mechanical invention, the development of the factory system, the consequent decline of production and increase of unemployment in the home, forced many needy women into factory and mill environment. The skill acquired in the home industries exerted a controlling influence on the choice of industries into which women went for a livelihood. Indeed, this early influence is apparent even at present. The largest number of women employed in factories in 1914 were making personal apparel; a slightly lesser number were spinning yarn and weaving it into cloth. Almost 200,000 were preparing food products for our consumption.

Table II showing the largest women-employing industries in the United States, therefore, gains in instructive interest when the industries represented therein are compared with the division of work as described at the beginning of the article between men and women before the development of the modern factory system.

Such a comparison brings out clearly the fact that women "invaded" principally the mills and factories producing commodities which were once woman's chief, if not exclusive, concern, when such commodities were of household origin.

Women in Mercantile and Clerical Pursuits.— The rate of increase in the number of women going into mercantile and clerical pursuits and professions since 1870 outstrips not only the rate of increase in the numbers of all bread-winning women, but exceeds the rate at which the total female population over 10 years

TABLE II.

PER CENT WHICH SIX INDUSTRIAL GROUPS EMPLOY OF THE TOTAL 1,539,190 WOMEN EMPLOYED IN ALL MANUFACTURING INDUSTRIES IN THE UNITED STATES IN 1914.

INDUSTRIAL GROUP	Number employed	Per cent. of total
Textiles (including cotton, linen, silk, felt, worsted and woolen goods)...	305,125	19 8
Personal apparel (including men's and women's clothing, hats, millinery, shirts, corsets and buttons).....	356,999	23 2
Hosiery and knit goods (including suspenders and elastic woven goods)..	113,995	7.4
Hand and foot wear (including leather and rubber boots and shoes, cut stock and findings, leather gloves and mittens).....	87,721	5.7
Tobacco manufactures.....	98,241	6 4
Food products.....	198,817	12 9
Total.....	1,160,898	75 4

This 75.4 per cent includes 63 of the 342 divisions into which the census of manufactures of 1914 has separated all industries. The remaining 24.6 per cent of women are employed in the other 279 industries.

of age has increased. This is shown by the table on page 459.

The women in mercantile and clerical pursuits are concentrated, as might be expected, in a very few occupations. The five occupations of saleswoman, stenographer and typewriter, bookkeeper and accountant, clerk and telephone and telegraph operator claim nearly 90 per cent of all women engaged in mercantile and clerical pursuits according to the occupation census of 1910.

Table III illustrates the pressure which the stream of women entering mercantile and clerical pursuits put upon the five occupational groups named.

Women in Professions.— Until shortly before the war school teachers in public and private institutions constituted an overwhelming majority of the "Women in Professions." Even in 1910 the teaching profession furnished nearly 500,000 of the total number of the approximately 750,000 reported in the occupation census of 1910. Beginning in the latter part of the last century, however, the number of women in other professions began to increase with great rapidity. While there were fewer than 2,500 women physicians and surgeons in this country in 1880, there were nearly 14,000 in 1910.* The same contrast is afforded by the number of "literary and scientific persons." The 1910 census of occupations shows but 579 chemists, assayers and metallurgists, but there are ample evidences that these and many other technical occupations were attracting large numbers of women even before the war.

The profession of law is drawing thousands of women, not all of them engaging in general practice by any means. Many are taking courses in law and securing admission to the bar in order to qualify for positions in legal departments of large corporations, civic and educational organizations and institutions, and frequently in various departments of the State and Federal governments.

* Consult United States 1910 census of occupations, page 54.

Seventh.— This group of occupations requires more academic training than the manufacturing and mechanical industries. Even the sales girl must be able to express herself fairly well, must write her sales checks legibly and compute her sales correctly. The clerk and stenographer must do better than the sales girl. The services of newly arrived immigrants or of the illiterate native born are, therefore, not available. The labor supply is confined to the graduates who are coming in rapidly increasing numbers from the common schools, the high schools, the business colleges and other schools of higher education.

Eighth.— This fundamental requirement of academic and technical training has resulted in confining the source of labor supply for the mercantile and clerical occupations to the families sufficiently ambitious and well circumstanced to afford their daughters the needed education. In other words, the demand for training has raised the pursuit in the "social scale."

Ninth.— What is true of the allurements of the mercantile and clerical pursuits as compared with the manufacturing and mechanical occupations applies even more closely but to a more limited number of women who have it in their power to enter professional pursuits.

The factor described in paragraph five of the foregoing summary particularly should not be overlooked, for while the desire to better or maintain her social position usually outweighs other factors in determining a woman's choice of an occupation, it is nevertheless true that the greater muscular exertion ordinarily required by manufacturing and mechanical industries shuts out from these activities many women of less than average physical endurance and makes it necessary for them to earn a living in occupations making lighter physical demands.

The Influence of the World War on the Entrance of Women into Industry.— In peace time the overwhelming majority of workers in all lines are engaged in supplying or distributing the normal demands of individual and family life. In war time the paramount demand upon industry is for means to destroy life — for guns, shells, powder and other explosives and for the necessary man power and equipment to make these effective against the enemy. The simultaneous shifting of stress from peace to war production and the drafting of the man power from industry to military and naval service inevitably changes the current of woman labor. How permanent the changes are only the results of succeeding censuses will show, but there are many evidences that the war emergency has materially checked the momentum of the movement of women into the old women-employing industries and familiar professions. For example, the records of the United States Employment Service for the period of the war showed a growing demand for women workers from employers in iron and steel and other metal industries; from lumber and timber mills and from the oil refineries. Without question the number of women bookkeepers and accountants has increased in a marked degree. Occupations in the banking business which were practically closed to women before the war drew large numbers of women to offset the shortage of men. Trade and business schools during the war threw open to women courses in banking and other responsible commercial positions which were not open to women before the war.

Finally the Federal government which, before the war, had offered opportunities to women chiefly in clerical, stenographic and other positions demanding little or no executive or technical training called women during the war into service requiring technical knowledge, executive ability and administrative experience of no mean order.

Of course, this war draft of women from homes into industry, and from accustomed occupations requiring little skill to unaccustomed positions of responsibility, did not proceed to the extent that it did in England. This was due, in the first place, to the longer duration of the war period in England and the consequent longer and greater drain on her man power; and, in the second place, to the fact that England entered the war at the outset with a preponderance of women over men, whereas the United States entered the war with a preponderance of men over women. It was not until the second draft had been made in this country that the demand for women to take the places of men began to make itself felt. The first draft served only to "take up the slack in male labor" notwithstanding the fact that the country's mills and factories had been supplying the allied nations with enormous quantities of war materials.

It would seem, therefore, that the demobilization of the American military and naval forces would have resulted in a corresponding reduction in the number of women drawn into industry. Evidences, however, do not sustain this conclusion. War conditions shut off the normal labor supply from immigration. Not only so, but conditions in Slavic countries set in motion a flow of emigration especially of the Slavic foreign born which made its influence felt on the general labor supply. In addition, the increasing demand for reconstruction materials and the revival of peace time requirements have made demands which readily absorbed labor rendered available by demobilization and also kept the war acquisition of woman labor busy in large measure.

On the whole, unquestionably the war has enlarged the opportunities of profitable employment for women, though as stated before, just in what measure and how permanent the enlargements are, only succeeding national census figures will determine.

The Economic Status of Women in Industry.— The influence of the war upon the wages of women need not be discussed in an article of this nature, as the war wages of women, like the war wages of men, are determined by war conditions which involve factors not included in the general problem of "securing to the worker an equitable share of the products of his work."

Obviously, the fundamental conditions determining the economic status of women in industry are wages, working conditions and cost of living. To one or more of these three all the problems of social and industrial unrest are related, for the cost of living involves the standard of living; working conditions involve

industries which are such conspicuous employers of women.

Whatever the cause of these discrepancies they should not be charged to the influence of children's wages, because they have been excluded from the comparison.

Sharp emphasis should be placed upon the fact that these discrepancies do not in themselves signify any inequitable division of the money paid in wages. One hundred dollars might be paid to five men for a given piece of work. The quality or grade of work done by two of the five might fairly call for a payment of $50 of the $100 to these two. In other words, it might be an entirely equitable arrangement for two-fifths of the workers to receive one-half of the wage money. A charge of unfairness in division of wage investment between men and women could be lodged only in case such division was not governed by the relative quality or grade of service rendered.

The significance of the paralleled bars lies in the alternative which they present, viz.: That women are either not rendering as high a quality of service or performing as high a grade of work as men in the same industries, or they are not possessed of equal bargaining power and are not, therefore, commanding equal pay for equal work. This alternative becomes a subject for serious thought in view of the fact that these industries not only employ the majority of women in manufacture, but they are the industries with whose fundamental processes women are by training and tradition acquainted. They are the industries which, with one exception, were once the chief domain of women, or were shared equally with men, and in which their skill was sufficient to be regarded as an asset by the pioneers in building up manufacturing industries in this country.

The encroachments which successive mechanical inventions have made upon the domain of skilled labor should not bear more heavily upon skilled women than upon skilled men. On the contrary if men of skill cost more than women of equal skill the factor of economy would tend to reduce the proportion of skilled male labor whenever superior physical strength is not required by the mechanical inventions.

There are ample data to show the extent to which men and women are performing the same occupations, but that does not measure the extent to which an equal degree of skill is required. Men and women may be performing the same occupations, but may be working on material of entirely different quality — one being much more difficult to handle and, therefore, requiring more skill and judgment. On the other hand, there are industries where the division of work is very marked, but this division does not mean necessarily that the sum of skill, speed and endurance required by one group of occupations is not equal to that required by another. For example, men and women do not perform the same occupations in pea canning, but it is a question whether the keen observation, the long concentration and quick decision demanded of a woman looking for pin point leaks in filled cans which pass her at the rate of 50 to 80 a minute do not call for as much skill as is exhibited by the male "tipper" who deftly seals the line of cans before they pass under *her* inspection.

The census does not furnish corresponding figures concerning the amounts paid men and women in mercantile and clerical pursuits. But there are many evidences, strengthened by the results of sporadic investigations, that of same conditions prevail in the wage scale of these occupations.

During the war the government agencies, notably the National War Labor Board, stimulated the efforts to equalize the wage scales of men and women by issuing official pronouncements in favor of "equal pay for equal work," but the records of awards by the board do not furnish evidence of effective application of the principle. The principle was also endorsed by the women in industry service of the United States Department of Labor, which was established by the Secretary of Labor during the war to set up standards of working conditions.

Organization among Women Wage-earners.— Because of the comparative brevity of the industrial life of the average woman wage-earner, organization among them for the improvement of working conditions proceeds much more slowly than among men. The short stay in industry which in turn limits the *stability* creates an apathy toward organization whose purpose is the permanent improvement in a field of activity in which the majority of wage-earning women do not expect to remain. It leads to a high turn-over in the membership of organizations which have succeeded in establishing themselves in spite of the disadvantage under which they labor. This turnover limits the opportunity of developing stable leadership from the ranks. But in spite of this handicap, able leaders have been developed through the trade unions and through the National Women's Trade Union League.

Legislation Regulating Conditions of Labor for Women.— Practically all the legislation regulating the hours, wages and working conditions for women in industry is restricted to women in stores, mills and factories and kindred establishments. The legislation has been enacted and judicially sustained upon the doctrine that the State has a peculiar stake in the health of its women as the mothers of its future citizens. Such legislation has been promoted unquestionably because of the weaker bargaining power of the wage-earning women. This weaker bargaining power is itself explained in large part by their short stay in industry and the consequences just described as flowing therefrom. While the laws for women in industry have always included provisions for minors, restrictive legislation for children has outstripped the laws guarding the working conditions of adult women.

At the time of the passage of the Federal Child Labor Law in 1916, barring children under 14 and restricting the hours of those between 14 and 16 to eight hours a day, there were but four States and the District of Columbia that had eight-hour laws for women. While the Federal law was annulled in 1918, the Federal tax on the products of establishments employing children had the same purpose. Laws barring women and children from dangerous trades go much farther in the restrictions laid upon the employment of children than they do in the restrictions laid upon the employment of women. In the framing of minimum wage laws there

is a noticeable effort to discourage the employment of children by giving officials power to establish minimum wages which would render the employment of children unprofitable.

These industrial improvement laws for both adult wage-earning women and for minors are undergoing constant modification and extensions by the State legislatures and efforts to secure Federal action were only suspended by the demands of the war. But through all these efforts to improve the wages, hours and working conditions of women and minors in industry there is developing a clearer and more effective recognition of the fundamental difference in the principles which must dominate legislation for women and those which shape the legislation for children.

In a word, the aim of restrictive legislation for adult women wage-earners, unlike that for child workers, is not their elimination from industry, but is improvement in the conditions under which their rapidly increasing numbers must labor. This difference throws much light on the greater difficulties in the way of securing effective protection through legislation for adult wage-earning women, and upon its slow progress when compared with similar legislation for children. It makes clear the double burden of responsibility resting upon the promoters of such legislation, the necessity of protecting the health of the wage-earning woman without restricting or imperiling her rightful place in the ranks of adult wage-earners. It is not a simple or an easy task, for the obligation to protect the adult woman's place in industry as well as her health carries with it the necessity of framing legislation which will not cripple industry or the adult woman's chances of earning a livelihood therein, but will only prevent industry from crippling or otherwise injuring its adult women workers.

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WOMEN'S CLUBS, associations of women organized for purposes of study, recreation, or for the promotion of certain philanthropic or political ends. Organization among women in the United States has grown to enormous proportions. It is impossible to compute with any degree of accuracy the membership of women's clubs, outside the federated bodies. The number probably reaches 3,000,000. Though it is generally said that women's clubs did not exist until the 19th century, there were clubs during the 18th century in the colonies. A "female club" was flourishing in New York in 1747 and there was an earlier one in 1735. The tea-table undoubtedly was responsible for social meetings in which the germ of the woman's club may be found. Reading circles and sewing societies, church societies and philanthropic societies existed throughout the country; but they were not organized. One of these early clubs was the Sharon Literary Club founded in January 1779, in Sharon, Conn., with the Rev. Cotton M. Smith chairman and John C. Smith secretary. The purpose was "to promote a taste for the study of *belles lettres* and of logic and to gain some skill in the useful Freeman's Art of Debate." The club published a magazine called *The Clio*.

The club movement did not begin until the 19th century. There was a Female Society for the Relief and Employment of the Poor in 1798; in 1834 the American Female Guardian Society was established, and in 1840–50 the Daughters of Temperance came into existence. During the Civil War a great number of organizations were formed, such as the Sanitary Commission, Women's Loyal Legion, Freedman's Bureau, to say nothing of the many philanthropic bodies, the outcome of the conditions. After the Civil War there was a demand for co-operation and popular education, and Sorosis and similar clubs were founded. Undoubtedly a great deal of impetus came from the suffrage organizations.

Suffrage Organizations.— In 1848 Elizabeth Cady Stanton and Lucretia Mott issued the first call for a national suffrage association. These two women presided and organized the association. It had been a disputed question whether any woman could, or would, be able to fill this important position, the decision ultimately being given in the affirmative, by the famous negro orator — Frederick Douglass. Susan B. Anthony immediately joined the other two women, and from their united efforts, "Individual Clubs" were formed. Their aim

as expressed in their platform being to "promote the educational, intellectual, legal and political equality of women, especially the right of suffrage."

From authentic records it has been proved that in 1859 Miss Constance Faunt Lee Roy founded the Minerva, a Woman's Literary Club at New Harmony, Ind., and Friends in Council, a reading club, founded in Quincy, Ill., in 1866. The "Sorosis" (q.v.), the first permanent woman's club organized, is still in existence.

The first associated work of women was religious and philanthropic. During the first 10 years of the 19th century a number of religious societies of women were organized to create funds and aid in church mission work, such as the "Cent" societies of 1801 and 1804. There were also women's auxiliaries to the Board of Foreign Missions. In 1839 there were 680 of these societies but their limited character prevented them from being productive, and they were nearly extinct by 1900. In 1864 the first independent union of women missionary societies was formed in New York by Mrs. Doremus and soon afterward every Protestant denomination had its organized Woman's Auxiliary to the American Board of Home and Foreign Missions. The oldest purely women societies in America were started for missionary and church work, and the first on the list of these was the Female Charitable Society of Baldwinsville, N. Y. Another early organization was the Piqua Ohio Female Bible Society, founded in 1818 with nine women. Toward the end of the century the society numbered 900.

"The early half of the century was marked," writes Mrs. Croly, one of the founders of Sorosis, in her 'History of the Woman's Club Movement,' "by a crusade for the cause of the better education of women. Simultaneous with this were two other movements — the anti-slavery agitation, inspired by the new enthusiasm for human rights and carried on largely by Quakers of both sexes, and the Woman's Rights Movement. The Woman's Rights Movement was the natural outgrowth of the individual sovereignty idea which the German philosophers had planted and of which Mary Wollstonecraft was the first great woman exponent. The keynote of the educational advance was struck by Emma Willard in 1821.

"The woman's club was not an echo, it was not the mere banding together for social and economic purpose like the clubs of men. It became at once, without deliberate intention or concerted action, a light-giving and seed-sowing centre of purely altruistic and democratic activity. It had no leaders. It brought together qualities rather than personages; and, by a representation of all interests, moral, intellectual and social, created an ideal basis of organization, where every one has an equal right to whatever comes to the common centre."

Sorosis was founded in 1868. In 1867 the Press Club of New York gave a dinner to Charles Dickens. A number of women who were either actively engaged in literary work, or connected with it in some manner, asked if they could be present at the dinner. It was ruled that they could not, although eventually a compromise was arranged and a few women attended the dinner — in some irregular way, probably as spectators in the gallery. The following year these same women met at the residence of Mrs. Charlotte Wilbour. All expressed their indignation regarding the Dickens Dinner incident, and the question — "Why cannot we have a club of our own?" came up and led to an organization formed by women, to which the name Sorosis was given.

The first meeting took place in March 1868 at the residence of Mrs. Croly. Alice Cary was made president; Mrs. Jennie C. Croly, vice-president; Kate Field, corresponding secretary; and Mrs. Charlotte B. Wilbour, recording secretary and treasurer.

Simultaneously with Sorosis the New England Woman's Club was organized in Boston by Mrs. Caroline M. Severance, and the first public meeting took place 30 May 1868 at Chickering Hall. Mrs. Julia Ward Howe, Mrs. Ednah D. Cheney, John Weiss, O. B. Frothingham, James Freeman Clarke and Ralph Waldo Emerson were present, for this club had the co-operation of men.

The Woman's Club of Brooklyn was founded in 1869–70 by Mrs. Celia Burleigh, who was made president. The Fortnightly of Chicago was founded in 1873, mainly through the efforts of Mrs. Kate Newell Doggett. Jane Addams and Mrs. Ellen M. Henrotin were members of this club. In 1876 the Chicago Woman's Club was founded by Mrs. Caroline M. Brown. In 1893 the Civic Club of Philadelphia was organized, the first of its kind. As early as 1853 the Laurel Hill Village Improvement Association was founded by Miss Mary G. Hopkins (Mrs. Goodrich) and Miss Sarah Yorke to improve Stockbridge, Mass. In 1886 the Woman's Health Protective Association of New York was organized.

Sorosis sent in 1873 "a little messenger" to prominent women throughout the whole world, calling together a "congress of women." This act received the commendation of thousands of women, including nearly all the reigning queens. This congress was held in New York at the Union Square Theatre, and formed an "Association for the Advancement of Women," which held congresses annually in various parts of the country, until it was superseded by the General Federation of Women's Clubs.

General Federation of Women's Clubs.— This organization was formed at a meeting called by Sorosis in New York, March 1889. On that date Sorosis reached its majority and celebrated its 21st birthday. The Federation was designed to bring in closer touch clubs from all over the country.

Soon after the formation of the General Federation, the different States began to agitate the question of State federations. The first State to organize was Maine, 4 Sept. 1892. The other States rapidly fell into line.

The board of directors of the General Federation of Women's Clubs consists of forty-nine women. The committees represent art, civics, civil service reform, conservation, education, home economics, industrial and social conditions, legislation, literature and library extension, music, public health and National Education Association, school patrons' department.

The New England section: Maine, 157 clubs, membership, 6,000; New Hampshire, 116 clubs, membership, 9,340; Vermont, 60 clubs, membership, 5,539; Massachusetts, 301 clubs, member-

It is a distinctive society in that it loans money to its members when sickness or sudden calamity overtakes them. To this class belong the educational and industrial unions. The Woman's Christian Temperance Union is a large active body, doing the work its name implies.

The International Sunshine Society, founded by Mrs. Cynthia Westover Alden, 1896, and incorporated 8 March 1900 has for its object: "To incite its members to the performance of kind and helpful deeds, and to thus bring the sunshine of happiness into the greatest possible number of hearts and homes." This is the largest individual club in the country, although it might be classed in the line of federations, as it has branches all over the United States and a few in other parts of the world. The estimated membership is 250,000.

The National Association of Colored Women was organized in 1894. Its motto is "Lifting as we Climb."

Mere mention of all the important organizations of women would require a large volume. Many of these bodies are federated with branches, or chapters, or units, in every State. One of the largest of the patriotic societies is the Daughters of American Revolution (D. A. R.), founded in 1890, with headquarters at Memorial Continental Hall, Washington. This numbers 140,853 members with chapters in all the States. The Daughters of the Revolution, founded in 1891, also has chapters in all the States. The National Society of Colonial Dames, founded in 1892, comprises 9,000 members. Its council meets in Washington every two years. Each State has its independent society and all are presided over by the national society. The Colonial Dames of America, founded in 1892, has also a large membership. In addition to these there are the Society of Daughters of Holland Dames; National Society of United States Daughters of 1812, 3,500 members; Pocahontas Memorial Association, 3,200 members; United Daughters of the Confederacy, 1894, 100,000 members; Daughters of the Cincinnati, incorporated 1894, the purpose of which is to educate a daughter of a naval or army officer with a view to self-support in teachers' college; Imperial Order Daughters of the British Empire in the United States; Mount Vernon Ladies' Association of the Union, founded in 1853, to care for Washington's home on the Potomac, 34 members; National Society of New England Women; National Society of Ohio Women; Society of Illinois Women; National Congress of Mothers and Parent Teachers' Associations, 1897, 100,000 members; National Women's Life Saving League, 1911, 2,000 members, to teach women and children swimming; American Nurses' Association, 3,500 members; Women's University Club, 1891, 1,200 members; New York Women's League for Animals, free hospital and dispensary, 1910, 1,500 members; Women's Municipal League, New York, 1,500 members; Women Lawyers' Association, New York, 1899, 250 members; College Women's Clubs; Association of Women Painters and Sculptors; National League for Women's Service, 1917, over 300,000 members, organizations of women volunteers doing economic and social emergency service; Vassar Students, 1889, 1,225 members; Camp Fire Girls, 1912, 100,000 members; Girl Scouts, 60,000 members; and the Needlework Guild in America, established in 1885 and incorporated in 1896, office in Philadelphia with 500 branches, the object of which is to furnish garments and household linen annually to hospitals, homes and other charities and special contributions in times of disaster.

Organization in Great Britain.—The principal London clubs are: Albemarle, established 1874, 1,100 members; Alexandra, 1884, 800 members; Automobile, 1903, 450 members; Empress, 1897, 2,500 members; Halcyon, 1911, 800 members; International, 1911, unlimited; Ladies' Army and Navy, 1902, 3,000 members; Ladies' Athenæum, 1904, 910 members; Ladies' Empire, 1902, 1,200 members; Ladies' Imperial, 1906, 2,300 members; Ladies' Park, 1905, 1,400 members; Lyceum, 1904, 2,400 members; New Century, 1899, 3,000 members; New Victorian, 1896, 800 members; Pioneer, 1892, 700 members; Sesame, 1895, 950 members; Three Arts, 1911, 1,200 members; University, 1887, no limit; Victoria, 1894, 450 members, and Writers', 1891, 400 members.

There are also in Great Britain the Woman's Liberal Federation; the Women's National Liberal Association; the Scottish Women's Liberal Association; Association of Women Clerks and Secretaries; Women's Imperial Health Association; Society for Promoting the Employment of Women; and National Union of Women Workers of Great Britain and Ireland, the governing body of which is the National Council of Women.

Many new organizations of women were founded in England during the war. The V. A. D. of the British Red Cross and the Order of Saint John of Jerusalem extended its work and many hospitals were opened in various parts of the country. The work on the Continent was also enormous.

The Women's Royal Naval Service, organized in 1917, has become a valuable society. The service consists of "mobile" and "immobile" women. The first could be sent anywhere; the second remained at home. The service is strict and exceedingly efficient. There are officers, chief section leaders, section leaders and ratings. The uniform is dark blue.

During the war the Women's Army Auxiliary Corps, 14,000 women, worked in direct connection with the fighting force and an additional 10,000 was called out each month. This, from its initials, was known as the "Waacs." In 1918 this Woman's Army Auxiliary Corps changed its name to Queen Mary's Army Auxiliary Corps, with the queen at the head. Large numbers were engaged in work in France. Their work consisted of every kind of employment undertaken by a soldier except actual fighting. The large majority are skilled workers. One duty is caring for the graves of those fallen in France. The Q.M.A.A.C. wears a khaki uniform. Some of its women have lost their lives in service.

The Navy, Army and Canteen Board also wears a khaki uniform. The Woman's Royal Flying Corps is an important organization. The members do not fly, but release men for duty. One section of the corps is that of motor bicycles. The Woman's Legion is expert in motor driving, which is one of its branches of work.

The Women's Land Army produced during

the war much of the home-grown food and cared-for stock and barn-yard produce. Women drivers of the Royal Mail were also among the new corps of women workers called forth by the war. The women police have also greatly increased. These bodies of women are all organized and properly governed. Among the recent societies are the Women's Service Bureau; Women's Farm and Garden Union; Women's Reserve Ambulance Corps; and Health of Munition Workers' Committee.

Working-women's Clubs.— The working-girls, or working-women's, clubs are organizations formed by industrial women and girls "to secure by co-operation means of self-improvement, opportunities for social intercourse and the development of higher, nobler aims." Among the most important of these are the League of Associations of Women's Clubs and the National Women's Trade Union League.

The working-girls' clubs arose out of practical needs. They began in London. The Soho Club and the House of 180, the Club and Working Girls' House and the Saint Giles's Evening Club for Working Girls were among the earliest. For these members many pleasures and excursions were provided. In 1883 the movement spread to this country and began with the Industrial Society of Hoboken, N. J., and the Working Girls' Society of 38th Street, New York, which later became the Irene Club. This movement soon extended throughout the country. In some cases the clubs were formed by the girls themselves; in others by noted club leaders, or church-workers. The National League of Women Workers, formed in Philadelphia, in 1897, by the Irene Club of New York, the Industrial Society of Hoboken, the New Century Guild and the Saint James Guild of Philadelphia and the Shawmut Club of Boston, is a notable instance of rapid growth. In 1916 it embraced 120 clubs and had 15,000 members. Its official publication is *The Club Worker*.

Germany was early in the field with such organizations. In 1865 the Berliner Lette Verein was founded for the improvement of the industrial efficiency of girls of the upper classes; and the Universal German Women's Union was for the improvement of women's education and the conditions of working-women. In 1888 the Union of Progressive Women's Unions was organized, which by 1910 had 23 branches, with 2,000 members and a paper, *Die Frauenbewegung*. In 1889 the Union of Women Employees was founded, which by 1915 had 150,000 members conducting a labor bureau, loan bureau and giving free legal aid. In 1889 the society *Jugendschütz* was established, with a hygienic and an ethical propaganda and maintaining a home for working-girls. Working-women have organized in Germany into Socialistic Trade-Unions. Two important national societies were in existence at the beginning of the World War: one was democratic and the other aristocratic. The first was *Bund deutscher Frauenverein*, Dr. Gertrud Baumer its president. The membership consists of half a million women. The second, *Der Vaterlandische Frauenverein* with 2,150 branches, evangelical and military, was called the *Armée der Kaiser*. At the beginning of the war the dissemination of all instruction for women in war economics was delegated to the League of Women's Domestic Science Clubs.

In France feminism and socialism were classed together in the Revolution of 1848. The woman movement did not take root until the Second Empire, when Maria Desraismes and Léon Richer founded in 1876 the *Société pour l'amélioration du sort de la femme*. This society was supported by Dumas fils, Victor Hugo and other men of note. In 1880 *La ligue pour le droit des femmes* was founded; in 1890 *L'Union universelle des femmes;* in 1891 *La Solidarité;* and in 1896 *Le feminisme Chrétien*. In 1909 the French Woman's Suffrage Society was organized. An organization of a different order is *L'Œuvre de la Chanssée du Maine*, founded in 1871 by Madame de Pressensé to assist child victims of the war of 1871. This has developed into a vast centre of activity in all branches of child-welfare. Among other organizations are *L'Accueil Française* devoted to the children of the invalided districts; *Pupilles de la Guerre* and *Veuves de la Guerre*, which were federated during the war into one society called *L'assistance de la mère et l'enfant*. The National Council of Frenchwomen and *L'Œuvre Parisienne*, the latter founded and directed by Madame Brundschvicq, accomplished prodigious results. The *Association des Surintendantes d'Usines* and *Infirmières visiteuses* were also organizations of far-reaching service during the war.

Among the first French women to mobilize were the members of the *Croix Rouge* (Red Cross), comprising the three great societies: *Secours aux Blessés Militaires; L'Union des Femmes de France;* and *L'Association des Dames Françaises*. The *Conseil National des Femmes* and the Women's suffrage unions — *Fédération Nationale, Alliance Nationale* and *L'Union Française* — also entered into war-work. These societies held a great meeting in the Sorbonne in 1915 and planned their work.

Conspicuous among women's organizations during the war was the Woman's Peace Party of America, which became the American Branch of the International Committee of Women for Permanent Peace. This was organized in 1 Jan. 1915, Jane Addams, chairman. During 1917 this organization maintained 200 local branches throughout the United States.

The scheme of the International Congress of Women was formulated at a small conference of women held in Amsterdam in February 1915. The result was that the Dutch women formed a committee, for an International Congress of Women to meet at The Hague. Fifteen hundred women convened there 1 May 1915, and conferred on international questions. The United States sent 47 members; Sweden, 12; Norway, 12; Italy, 1; Hungary, 9; Germany, 28; Denmark, 6; Canada, 2; Belgium, 5; Austria, 6; Great Britain, 3 and Holland 1,000. The president of the International Committee of the Congress was Jane Addams of Chicago.

The American women came forward magnificently to aid in war work. The Red Cross with its 5,000,000 members and 3,000 units produced chapter work-rooms, each of which was a little organism contributing to the whole. The National League for Woman's Service in six months drew to itself 300,000 members.

The Women's Committee of the Council of National Defense held a meeting in Washington, 1 June 1917, at which 200 national organizations of women met and outlined plans for work and service. The War Work Council of the Young Women's Christian Association; the Division of Women's War Work of the Committee on Public Information; the Stage Women's War Relief; the Council of Jewish Women; the League of Catholic Women; the Women's Land Army; the Hadessah Women's Zionist Organization for Relief Work in Palestine and the Mayor's Committee of Women in many cities and towns are among the most conspicuous of the societies produced by the war. The most important and perhaps the latest society of importance is the Woman's Council, League of Nations Association.

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ESTHER SINGLETON,
Author of 'Social New York Under the Georges', 'Furniture of Our Forefathers'; 'Guide to Modern Operas'; 'A Daughter of the Revolution', etc.

WOMEN'S CLUBS, General Federation of, an organization incorporated in the United States, in 1892, and within a few years was composed of over 2,675 women's clubs, having a membership of 155,000 women in the United States and foreign countries. The purpose of the federation was declared in its articles of incorporation to be "to bring into communication with one another the various women's clubs throughout the world, that they may compare methods of work and become mutually helpful. Constitutions of clubs applying for membership should show that no sectarianism or political test is required, and, while the distinctively humanitarian movements may be recognized, their chief purpose is not philanthropic nor technical, but social, literary, artistic or scientific culture." Meetings of the federation are held biennially. There are now federations in all of the United States and some of the territories, and allied organizations exist throughout the civilized communities of the world. The federation in New York State is far the largest, including nearly 500 clubs and over a quarter of a million individual members. See WOMEN'S CLUBS.

WOMEN'S HOME MISSIONARY SOCIETY. See METHODIST CHURCHES OF THE WORLD.

WOMEN'S RIGHTS is the term applied to the claims, made on behalf of women, to a legal, political, educational and social status equal to that of men. The modern movement in this direction dates from about 1848, having begun in the United States. Notwithstanding the ridicule which assailed its early advocates, the claims of women have been largely recognized. As the crusade advanced, it assumed form in the Woman Suffrage (q.v.) movement.

WONDER-WORKING MAGICIAN, The (*'El Mágico Prodigioso'*). The superficial resemblance between Calderon's play and Goethe's 'Faust' has made this one of the best known of Spanish dramas. Goethe, who was ignorant of Calderon's play when he wrote the first part of 'Faust,' but jealous of the Spanish playwright's extraordinary popularity during the early decades of the 19th century, said with much truth and some bitterness, "it is the subject of Doctor Faust treated with incredible vulgarity" (1812). In Calderon's work, 'Cipriano,' a passionate young gentleman is distracted from the pursuit of love by his studies, but upon seeing beautiful Iustina, he becomes enamored and makes a pact with the devil in order to win her. He is inspired by no yearning for knowledge or power over natural forces, but becomes simply one more of the countless victims of unbridled passion found in Spanish literature of the golden age, the immediate prototype being in the present instance Friar Giles of Mira de Mesqua's 'El Esclavo del Demonio' (1612). In 'Faust,' on the other hand, we have an old man who has lost faith in science and divine power, and makes a pact with the devil in order to obtain rejuvenation. Only the incriminating charter is common to the two plays. Calderon wrote his drama for a religious celebration in the town of Yepes, 1637. For his plot he had recourse to the legend of Saint Cyprianus and Saint Iustina of Antioch, who suffered martyrdom in the early centuries of the Christian era. The

at the head of his command. A monument to his memory was erected at West Point.

WOOD, Ellen Price, English novelist, best known as MRS. HENRY WOOD: b. Worcester, 17 Jan. 1814; d. London, 10 Feb. 1887. In 1836 she married Henry Wood, a member of a banking and shipping firm, and from then till 1856 lived in France. She began her literary career by contributing to *Bentley's Miscellany* and the *New Monthly Magazine*, and in the ingenuity of her plots excelled all her English contemporaries. In 1867 she became editor and proprietor of the *Argosy* magazine. Her books are not sensational, in the ordinary acceptation of the term, and display beside remarkable constructive skill, not a little keen character drawing and descriptive power. They have been widely circulated both in this country and England, and among them are 'East Lynne' (1861), which has had an enormous success both as a book and a drama, and still continues to be popular; 'Mrs. Halliburton's Troubles' (1862); 'The Channings,' which is a most entertaining study of schoolboy life (1862); 'The Shadow of Ashlydyat' (1863); 'A Life's Secret' (1867); 'Roland Yorke' (1869), a continuation of 'The Channings'; 'Dene Hollow' (1871); 'Within the Maze' (1872); 'Edina' (1876); 'Pomeroy Abbey' (1878); 'Court Netherleigh' (1881); 'The House of Halliwell' (1890); and the 'Johnnie Ludlow Stories' (1874–80). Consult 'Memorials' by her son (1894).

WOOD, SIR Evelyn, English general: b. Cressing, Essex, 9 Feb. 1838; d. 2 Dec. 1919. He was educated at Marlborough College and joined the navy in 1852. During the Crimean War he served in the Naval Brigade and was severely wounded while carrying a scaling ladder to the Redan. In 1855 he entered the army as coronet, in 1858 served in India as a brigade-major and received the Victoria Cross for conspicuous valor, December 1859. In 1873 he served in the Ashantee War, and on his return from this campaign was called to the bar at the Middle Temple (1874). He served in the Zulu War of 1879 and was promoted to the rank of brigadier-general after his victory at Kambula. He was second in command of the British forces in the brief Transvaal War of 1881, and in 1882 went to Egypt as commander-in-chief or sirdar. In 1893 he became quartermaster-general to the forces, and held that position until his appointment in 1897 to the office of adjutant-general. He published 'The Crimea in 1854' (1894); 'Cavalry at Waterloo' (1896); 'Cavalry Achievements' (1906); 'The Revolt in Hindustan' (1908); 'Our Fighting Services' (1916); 'Winnowed Memories' (1917). Consult 'Life' by Williams (1892).

WOOD, Fernando, American politician: b. Philadelphia, 14 June 1812; d. Washington, D. C., 14 Feb. 1881. In 1820 he removed to New York, where he was educated, and entered business as a shipping merchant. He early became identified with political organizations and was active as campaign writer and orator. He was elected to Congress in 1840 on the Democratic ticket, serving one term. In 1850 he retired from business and in that year was the Tammany candidate for mayor of New York, but was defeated. As candidate of the same organization in 1854 he was elected mayor of New York; introduced various reforms and was re-elected in 1856 almost without opposition. Discussion in the organization led him and his followers to form a rival body called Mozart Hall. He was the unsuccessful candidate for mayor of this organization in 1858, but in 1860 was a third time elected mayor in opposition to both Republican and Tammany candidates. In 1861, when secession was under discussion, he recommended that New York should secede and become an independent city. He served in Congress in 1863–65 and 1867–77.

WOOD, Francis Carter, American pathologist: b. Columbus, Ohio, 30 Dec. 1869. He was graduated at the Ohio State University in 1891, at the College of Physicians and Surgeons, Columbia University, in 1894, and later studied at the universities of Berlin and Vienna. He established himself in practice in New York and became pathologist and attending physician at Saint Luke's Hospital. He was professor of clinical medicine at Columbia University in 1906–12; and since 1912 he has been professor and director of cancer research under the George Crocker Special Research Fund at Columbia. He is also connected with the leading New York hospitals. Besides many medical papers he is author of 'Clinical Diagnosis' (1899); 'Chemical and Microscopical Diagnosis' (1905).

WOOD, George Bacon, American physician: b. Greenwich, N. J., 13 March 1797; d. Philadelphia, Pa., 30 March 1879. He was graduated from the University of Pennsylvania in 1815 and from its medical department in 1818, and was professor of chemistry at the Philadelphia College of Pharmacy 1822–31, and of materia medica there 1831–35. He held the chair of materia medica at the University of Pennsylvania 1835–50, and of the theory and practice of medicine there 1850–60, endowing an auxiliary faculty of medicine in the university in 1865. He published 'Treatise on the Practice of Medicine' (1847); 'Therapeutics and Pharmacology' (1856); and with Franklin Bache prepared 'The Dispensatory of the United States' (1833; 17th ed. 1894).

WOOD, Mrs. Henry. See WOOD, ELLEN PRICE.

WOOD, Henry A(lexander) Wise, American inventor, son of Fernando Wood (q.v.): b. New York, 1 March 1866. He made a large number of inventions of use in the printing trade, most important of which is the autoplate, a machine for making plates for newspaper use, which formerly were made by hand. He has the record of taking out more patents on printing press machinery than any other inventor and is president of the Wood Newspaper Machinery Corporation. He early interested himself in aeronautical engineering, was vice-president of the Aero Club of America, and president of the American Society of Aeronautical Engineers. In 1915 he was appointed to the Naval Consulting Board, but later resigned. He was chairman of the conference committee on National Preparedness, and a supporter of Roosevelt for the presidential nomination in 1916. He is editor of *Flying*, and author of 'Fancies,' poems (1903); 'The Book of Symbols,' poems (1904)); 'The Money Hunger' (1908).

WOOD, Horatio Curtis, American physician: b. Philadelphia, Pa., 13 Jan. 1841. He was graduated in medicine from the University of Pennsylvania in 1862, and was professor of botany there 1866–76, and clinical professor of diseases of the nervous system from 1875 to 1901; professor of therapeutics 1876–1907, and thereafter emeritus professor of therapeutics. In addition to many professional papers he is the author of 'Thermic Fever' (1872); 'Materia Medica and Therapeutics' (1874; 11th to 13th editions rev. with son, Horatio Charles Wood, 'Therapeutics, Its Principles and Practice,' 1899); 'A Study of Fever' (1875); 'Nervous Diseases and their Diagnosis' (1887); 'Syphilis of the Nervous System' (1889).

WOOD, Irving Francis, American biblical scholar and educator: b. Walton, N. Y., 27 May 1861. He was graduated at Hamilton College in 1885, at Yale University in 1892, and took the degree of Ph.D. at the University of Chicago in 1902. He taught at Jaffna College, Ceylon, in 1885–89; was appointed professor of ethics and biblical literature at Smith College in 1893, and now holds the chair of biblical criticism and comparative religion there. He is joint author of 'The Bible Story' (5 vols., 1906); 'The Days of the Kings of Israel' (1908); 'The Bible as Literature' (1914); and author of 'The Spirit of God in Biblical Literature — A Study in the History of Religion' (1904); 'Adult Class Study' (1911).

WOOD, James Frederick, American Roman Catholic prelate: b. Philadelphia, Pa., 27 April 1813; d. there, 20 June 1883. He was educated in England and on returning to the United States entered the banking business. In 1836 he went to Rome to study for the priesthood and after his ordination in 1844 became an assistant rector of the cathedral at Cincinnati, and afterward pastor of Saint Patrick's Church. In 1857 he became bishop of Philadelphia, where he completed the magnificent cathedral in Logan Square. He also established at Overbrook the Seminary of Saint Charles Borromeo. He was created archbishop in 1875. He was especially opposed to the introduction of political issues from other countries to the United States.

WOOD, John George, English naturalist and Anglican clergyman: b. London, 21 July 1827; d. Coventry, Warwickshire, 3 March 1889. He was graduated from Merton College, Oxford, in 1848, and took orders in the English Church. In 1856–62 he was chaplain to Saint Bartholomew's Hospital, in 1858–63 a reader at Christ Church, Newgate Street, and for seven years from 1869 conducted the festivals of the Canterbury Diocesan Choral Union. During 1879–88 he delivered numerous lectures on natural history in Great Britain and America. His numerous works contributed very greatly to popularize natural history. Among them are 'The Illustrated Natural History' (1851); 'Bees' (1853); 'Common Objects of the Sea-Shore' (1857); 'Common Objects of the Country' (1858); Routledge's 'Illustrated Natural History' (1859–63), his most important work; 'Common Objects of the Microscope' (1861); 'Our Garden Friends and Foes' (1863); 'Homes Without Hands' (1864–65); 'Common Shells of the Sea-Shore' (1865); 'Fresh and Salt Water Aquarium' (1868); 'Natural History of Man' (1868–70); 'Bible Animals' (1869–71); 'Insects at Home' (1871–72); 'Insects Abroad' (1874); 'Man and Beast: Here and Hereafter' (1874); 'Field Naturalist's Handbook' (1879–80); 'Half-Hours in Field and Forest' (1884); 'Half-Hours with a Naturalist' (1885); 'Romance of Animal Life' (1887). Consult 'Life' by his son the Rev. T. Wood (London 1890).

WOOD, John Seymour, Amrican lawyer: b. Utica, N. Y., 1 Oct. 1853. He was graduated at Yale in 1874 and at Columbia Law School, 1876. He was editor of the *Bachelor of Arts Magazine* (1896–98), and has published 'Gramercy Park: A Story of New York' (1892); 'A Daughter of Venice' (1892); 'College Days' (1895); 'A Coign of Vantage' (1896); 'Yale Yarns' (1897); 'An Old Beau, and Other Stories'; 'A Nippon Garden' (1915)

WOOD, Leonard, American soldier and administrator: b. Winchester, N. H., 9 Oct. 1860. He was graduated at the Harvard Medical School in 1884, and in 1885 became a contract-surgeon in the United States army. In 1886, as first lieutenant and assistant surgeon, he served in the campaign against Geronimo and was awarded a medal of honor for his services. In 1898, when the war with Spain began, he received authority to raise and was commissioned as colonel of the first volunteer cavalry, commonly known as the "Rough Riders." Theodore Roosevelt was lieutenant-colonel of this regiment and succeeded to its command on General Wood's promotion. Colonel Wood commanded the regiment at Las Guasimas and the second cavalry brigade consisting of the first volunteer cavalry (Rough Riders) and the first and tenth regular regiments of cavalry at San Juan Hill. On 8 July 1898, he was, on the recommendation of his superiors, appointed brigadier-general of volunteers for services at San Juan and Las Guasimas. On the surrender of the city of Santiago, he was appointed governor of the captured city and later, on the relief of General Lawton, he was made governor of all the captured territory embracing the eastern portion of Cuba, including the province of Puerto Principe and Santiago. On 7 Dec. 1898, he was appointed a major-general of volunteers in recognition of his services as governor of the captured territory. On 13 April 1899 he was mustered out as major-general of volunteers and reappointed on the same day as brigadier-general of volunteers and continued in this grade until 5 Dec. 1899, when he was again appointed as major-general of volunteers and designated to relieve Maj.-Gen. John R. Brooke as military governor of Cuba. General Wood continued in this capacity until its transfer as an organized republic to the duly elected Cuban government through its representative, Thomas Estrada Palma, the duly elected president.

During this period of reorganization school laws were written, sanitary regulations were enforced throughout the island, laws of public works and charities were revised and rewritten, an entirely new railroad law was prepared and put in force and most extensive judicial reforms accomplished. Especially great attention was given to sanitation, schools and courts. It was under General Wood's supervision that Maj. Walter Reed and his assistants, Doctors Carroll and Lazear of the medical department, conducted the great work which led to the dis-

covery of the means of transmitting yellow fever and consequently of its control. The death rate of the island was greatly reduced and the system of public education established proved to be admirable.

On 4 Feb. 1901, General Wood was appointed a brigadier-general of the regular army. During his incumbency of the office of military governor of Cuba, the post-office cases occurred which led to the indictment, trial and conviction of Rathbone and others and incidentally, through their friends, resulted in an effort to defeat General Wood's confirmation as major-general. He was, however, confirmed by an overwhelming majority, 8 Aug. 1903. In the fall of 1902 he was one of the representatives of the United States government at the Imperial German manœuvres. In March 1903, at his own request, he was detailed for duty in the Philippine Islands and continued in foreign service until November 1908. While there, he was in command of the Department of Mindanou and the first civil governor of the newly organized Moro province, which included the Mohammedan section of the Philippine Islands. After numerous campaigns he was successful in quelling the organized opposition to occupation by the United States. He later received the assignment of commanding general of the Philippine division, which position he held until relieved from duty in the islands. On his return to the United States, he was assigned to the command of the Eastern Department, which command he exercised until his detail as chief of staff, United States army, 22 April 1910. In the same year, he was designated special Ambassador of the United States to the Argentine Republic, on the occasion of the celebration of the 100th anniversary of that country's independence. Upon completion of his duties as chief of staff (1914), he was reassigned to the command of the Eastern Department, which he held until 1917, when he was appointed in command of the southeastern department, a subdivision of his old command. In 1908 General Wood began his vigorous work on preparedness and pushed it through the length and breadth of the land on all possible occasions. The work was advanced with increasing vigor from year to year and reached its climax in 1913, with the establishment of the training camps of Plattsburgh. While in command of the Southeastern Department, General Wood selected 12 of the National army cantonments for the training of the National army.

While at Camp Funston General Wood organized and trained the 89th division and later on the 10th regular division, with a number of pioneer regiments and special organizations. He was sent overseas on a tour of observation, was quite seriously wounded, was in a French military hospital for some weeks and returned to the front and completed his tour of observation. When the 89th division was ordered to the front General Wood accompanied it to the sea and was there relieved and sent back to Camp Funston, where he organized and trained the 10th regular division and was in command of it at the time of the armistice.

The degree of LL.D. was given General Wood by Harvard University (1899); Williams College (1902); Pennsylvania (1903); Princeton (1916); University of the South and University of Georgia (1917); University of Michigan (1918); Union College, New York, and Wesleyan, Connecticut (1919). He received the degree of Doctor of Military Science from Norwich University and from Pennsylvania Military College (1912). General Wood holds a Congressional Medal of Honor (Geronimo campaign); is fellow of the Royal Geographical Society; member of the Society of the Cincinnati; the Society of Colonial Wars, Sons of the Revolution, Foreign Wars, Indian Wars, and of the Spanish-American War. He is fellow of the Academy of Sciences of Havana and Governor-General of the Mayflower Society of the United States. When he represented the United States at the German manœuvres in 1902 and the French and German manœuvres in 1908, he was named Grand Officer of the Legion of Honor, permission to accept which distinction was withheld by the United States. Authority to wear this decoration was granted subsequently in the general order which authorized American officers to wear foreign decorations. Besides numerous magazine articles on preparedness, General Wood is the author of 'The Military Obligation of Citizenship' (1915); 'Our Military History' (1916); 'National Defense' (1917); and 'Universal Military Training' (1917). Consult Bangs, J. K., 'United States Trustee'; 'Cuba: Civil Report of General Wood' (1901); 'The Military Government of Cuba' (in 'Annals of the American Academy of Political and Social Science', Vol. XXI, No. 2, 1903); Baker, 'General Leonard Wood' (in *McClure's*, Vol. XIV, pp. 368–79, 1900); 'The Case of General Wood' (in the *Outlook*, 2 Jan. 1904); 'The Amazing Case of General Wood' (in *Scientific American*, 15 June 1918); 'The Removal of Maj.-Gen. Leonard Wood' (ib. 14 April 1917); 'Resentment over the Treatment of General Leonard Wood' (*Current Opinion*, July 1918); and Marcasson, T. F., 'Leonard Wood, Prophet of Preparedness' (1917); 'The Career of Leonard Wood' (1919).

WOOD, Robert Williams, American physicist, b. Concord, Mass., 2 May 1868. He was graduated at Harvard University in 1891, studied at Johns Hopkins University in 1891–92, and at the University of Berlin in 1892–94. He was connected with the faculty of the University of Wisconsin in 1897–1901; and since 1901 has been professor of experimental physics at Johns Hopkins University. He was appointed major in the Officers' Reserve Corps in August 1917, and was later engaged in scientific service in France. He was the originator in 1898 of the electrical method of thawing frozen water mains and service pipes; has made important researches in the theory of light, for which he was awarded the Rumford medal of the American Academy of Arts and Sciences; and for his work in color photography he received medals from the London Society of Arts in 1900, the Franklin Institute in 1907, and the Dresden International Exhibition in 1909. He is joint author with A. C. Train of 'The Man Who Rocked the Earth' (1915); and author of 'Physical Optics' (1905; rev. ed., 1915); and of two books of humorous verse, 'How to Tell the Birds from the Flowers' (1907); 'Animal Analogues' (1908).

WOOD, Thomas John, American soldier, b. Munfordville, Ky., 25 Sept. 1823; d. Day-

traces of it have disappeared. Cæsar's bridge is well known to all students. The huge concrete and stone buildings of the Roman empire were built on wooden centring, which was as carefully constructed as if it were to be permanent itself. The half-timber work of the Middle Ages where the framing was made of heavy timbers was filled in between with plaster, making a very solid permanent construction. The ceilings of the churches of the Middle Ages were frequently worked out in timber, and many of the Gothic churches had timber roofs, which followed out the feeling of the Gothic style. The shingle architecture of the modern American country house, the old colonial buildings and the still earlier log cabins

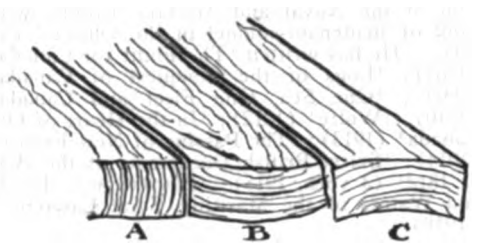

FIG. 1.

are good examples of what can be done with wood construction. The defects of timber are caused by splitting, knots, rot, sap-wood and warping. Timber should have a straight grain, should be well seasoned, and if not weather-seasoned, should be kiln-dried.

The development of the modern system of wood framing resembles strikingly the still more recent American methods of steel construction, as both are a veneer on a simple framework. Neither the country house nor the office building expresses its constructive features on the exterior. This, of course, has an economic cause: it is much easier to start the rough carpentry with the sill when the mason has completed his wall and carry out all the rough framing and boarding with the knowledge that none will show as finished work; all the effort will tend to rapidity and strength. The exterior is then covered with shingles or clapboards, and the interior with lathing and plastering, leaving a finished plaster surface. Then follows the "joiner" or carpenter for the finished interior work, which is put in after the plastering is dry, and therefore is entirely separate in time and character from the rough framing.

Defects in Timber.— It is very important to remove the sap-wood with care, for it constitutes a soft, spongy mass, containing fermentable sap and allowing dampness to penetrate very easily; rot develops and worms appear, and from the sap-wood, go through the whole substance. Lumber is piled or "stuck" after it is sawed with small sticks of wood between the pieces to allow a circulation of air, and allowed to remain for several months. For interior finish, the wood is generally seasoned by artificial means, that is, "kiln-dried." The pieces are put in a room heated by steam to a temperature of about 150° F. and allowed to remain for several days or weeks until thoroughly dry.

Preservation of Timber.— Up to the present time the greatest attention has been given to the preservation of railroad ties. The principal processes are those where either creosote or zinc chloride is used. Sometimes a combination is employed. All French and English ties use the creosote process, which gives them a life of 20 to 25 years. A recommended combination is 38 per cent dead oil of coal tar, 60 per cent resin melted, 2 per cent formaldehyde. Inject this after raising the timber to 250° F.

Quarter-sawing.— This term is applied to a log cut lengthwise into quarters, so that the quarters can be cut into boards parallel to the radius of 45 degrees between these cuts. These sections are so nearly in the plane of the medullary rays that they show the best grain, especially in oak, and boards cut in this way are less likely to warp and show little shrinkage. Often the grain of wood which renders it weak will give a good effect for paneling or veneering. In Fig. 1, plank A is quarter-sawed and will lie flat and will not splinter; plank B is poorly cut, being taken from one side of the log, as in Fig. 2, A. If the first board were

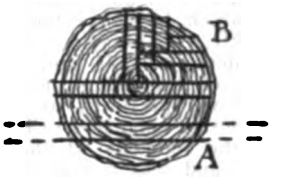

FIG. 2

taken directly through the centre of the log and the others parallel or perpendicular to it the grain would lie nearly parallel with the medullary rays as shown at B (Fig. 2). In Fig. 1, plank B is poorly laid and would stand much better if laid with the heart or hollow side down, as in Fig. 1, C.

Framing.— From the period of the first settlement of America, the cheapness of wood has made it the popular building material. The log-cabin was built of the logs cut when the early settlers cleared the land. Two sides were adzed off and the ends of the logs were notched so as to fit closely at the corners. The cracks were filled in with mud and the roof framed with small roughly-worked rafters which were covered with split shingles. The advent of the saw-mill soon brought into use "dimension" lumber, rectangular in section, to be set so that its broadest side would take the strain. For example, two-inch by eight-inch floorings 12 inches or 16 inches apart and strongly braced or "bridged" by small pieces nailed in between, took the place of 10-inch by 10-inch timbers which spanned the same space at greater intervals but necessitated the use of much more timber on account of their own size and also because of the larger amount of timber necessary for filling in between. This evolution has brought us to two methods of wood construction, the "full frame" and "balloon framing," the latter being used for small buildings, such as ordinary dwelling-houses only.

Northern Pine (rare) (*Pinus sylvestris*) is also called Norway pine and Scotch fir, and is known in Great Britain as red or yellow deal. It is found in the northern parts of Europe, especially in Scandinavia on the mountains where there are large forests of these trees. Its color is warm with reddish tones. When first cut it is very resinous. It is one of the

VARIOUS WOODS

most useful pine woods and is strong, durable and easily worked. Its timber, which is used in both civil and naval architecture, is exported from Norway, Sweden, Prussia and Russia.

Canada Red Pine (*Pinus resinosa*).— This wood is sometimes called Norway pine. It takes the name of red pine from the color of its bark. The trees are found throughout Canada, but the best red pine is found in the northern parts of Wisconsin and Minnesota. The trees are sometimes 140 feet high. Its wood is tough, and has but few knots. It is used in construction of all kinds, flooring, piling, etc.

White Pine (*Pinus strobus*).— Also called Weymouth pine after Lord Weymouth, who planted it first in England in 1708. The trees are found in large forests in Canada and in the Great Lakes region. The wood is soft and easily worked, of a straight grain, of a light straw color and has but few knots. The tree is tall and impressive, reaching sometimes 200 feet in height. It was formerly the most extensively used soft wood in America.

Yellow Pine (*Pinus mitis*) is also called short-leaved pine, to distinguish it from the long-leaved Georgia pine. It is a native of the Western and Southern States. West of the Mississippi its hard fine grained wood is made into timber, but the timber is not so large as that of the Georgia pine.

Georgia Pine (*Pinus palustris*), known as the long-leaved or Georgia pine and as the turpentine tree. Its wood is coarse and owing to its having so much resin it is extremely difficult to work. The wood is used for coarse lumber, shipbuilding, heavy timber, and for obtaining tar, pitch and turpentine.

Norway Spruce (*Picea excelsa*) is a tree which attains great height, often growing as high as 150 feet, and is a native of the northern parts of Europe and Asia. Its branches grow quite near to the ground as do all firs. This wood has many hard knots, which makes it very difficult to cut. It is used nevertheless for masts, spars, boards, etc. Large quantities are shipped from Russian ports and some of the best stock comes from Christiania.

American Spruce (*Picea nigra*), or black spruce, much resembles the Norway spruce except that its color is grayer and colder. It grows from 50 to 70 feet in height and is found in British America and northern parts of the United States. Its wood is light and strong and is much used in shipbuilding, and general rough framing.

Cedar, an evergreen tree of the coniferous genus. Its wood is soft and of a reddish brown color and sometimes has a very fragrant odor. It is used for chests and cigar boxes. There are three known species of cedar. The cedar of Lebanon is noted, of which there still remains a grove of some 400 trees.

Basswood (*Tilia americana*).— This wood is the American Linden or lime tree; it is also called bass. It is a yellow ochre in color and straight-grained. It does not wear very well but stains and polishes easily.

American Whitewood (*Liriodendron tulipifera*) is the whitish timber of the tulip tree, the wild cinnamon, basswood and Guiana plum trees. It grows in the Middle States. Its wood is of a pinkish gray color, very soft and of a fine surface. It is used largely for sheathing and is exported from New York and Phila-

Birch American (*Betula lutea*), called also yellow birch. This tree has a smooth outer bark, close grain, moderately hard wood and is used for making furniture, for fuel and other purposes. The oil from its bark is used to give Russia leather its odor.

Ebony (*Diospyros ebenacea*) is the name given to a wood of a very dark color. It is very hard and heavy and often jet black and sinks if put into water. It takes a fine polish and is much used for high class cabinets, toilet sets, inlaying, making flutes, etc. It is a native of the flat parts of Ceylon. Its usual color is black, but the variety in Jamaica is green.

Beech (*Fagus*) is a large straight tree with beautiful thick foliage. Its height is from 50 to 70 feet. The bark has a smooth, hard surface and is blue gray in color. Beech is not much used for building work, for it is not durable except when very wet or very dry. It warps but little and its hardness makes it well fitted for making a great variety of tools and for cabinet work.

Oregon Pine (*Pseudotsuga taxifolia*), known also as Oregon fir, Nootka fir and Douglas pine. Large forests of these trees grow in the western part of the United States and Alaska.

The following are the various kinds of lumber which are used for different purposes:

Piles.— Oak, elm, beech, spruce. Posts set in the ground, hemlock, acacia.

Strong Construction.— Oak, teak, yellow or Georgia pine. Available in damp situations, oak, beech, elm, acacia, alder, chestnut. For large timbers, Oregon pine, Georgia pine, oak, bay mahogany, chestnut.

Floors.— Oak, maple, birch, beech and rift Georgia pine are the best floors for hard wear; North Carolina pine for cheaper floors, and spruce floors where they are to be covered or painted. Oak, hard pine, teak will wear the longest.

Interior Finish and Panels.— Cypress, North Carolina pine, oak, mahogany, sycamore.

Window Sills.— Oak, white pine, mahogany.

Stair Treads.— Oak, hard pine, teak. For school interior finish, ash, hard pine, North Carolina pine.

The wood products of American forests, as shown in the last United States Industrial Census were worth $715,310,333.

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FRANK A. BOURNE,
Architect, Boston, Mass.

WOOD ALCOHOL, WOOD NAPHTHA, WOOD SPIRIT, etc. See ALCOHOL.

WOOD-BORING BEETLES, beetles which lay their eggs in or upon wood, into which the larvæ begin to bore immediately after hatching and from which they derive their sole sustenance. Living upon this innutritious substance their growth is generally slow, and by the end of the several years spent in the larval condition they have often excavated extensive galleries which increase in diameter as the larvæ grow. The larvæ of many beetles feed upon dead or decaying wood only, and many of these may be considered useful to man, as they assist in reducing stumps and fallen limbs to a condition of vegetable mold. Others confine their attacks to the bark and are seldom serious pests. Many species bore into sound wood either in the standing growing tree, in the dressed lumber, or even in the finished house or article of furniture. Such often commit incalculable damage. The families *Cerambycidæ* and *Buprestidæ* are notorious as comprising species almost exclusively of wood-boring habits, and those whose larvæ do not excavate wood burrow into roots or soft plant tissues. The *Cerambycidæ* (q.v.), or longicorn beetles, include one of our largest beetles, the broad-necked prionus (*Prionus laticollis*), which reaches a length of nearly two inches and is unusually robust for the family; it is of a deep brown-black color, and the jaws are exceedingly stout. The great white larvæ are two or three inches long and bore into the roots of forest and orchard trees and blackberry plants. The latter are quickly killed and even large trees will succumb if the borers are abundant. They live three years. The apple-tree borer (*Saperda candida*) in the beetle state is brown with a conspicuous white stripe running the entire length of the body on each side above. It flies mostly at night during the early summer months and lays its eggs on the trunks of apple, quince and pear trees near the ground. The larva is cylindrical and very strongly annulated and when fully grown is an inch long. It lives three years, the first one being spent in the sap-wood, the others in the interior of the trunk. Its attacks are frequently fatal and the only effective measures are preventives. A strip of tin or wire gauge nailed to the tree trunk from the ground to a height of two feet will prevent most of the females from depositing their eggs. Another exceedingly serious pest is the locust-tree borer (*Cyllene robiniæ*) which has habits similar to the last and which often riddles the trunks of locust-trees with its burrows, killing them in a few years. The beetles are very pretty, being dark velvety brown, with angulated cross-lines of yellow. They abound during the early autumn and feed upon the pollen of the goldenrods. Numerous closely related species attack other hardwood trees. A peculiar habit is possessed by the twig-girdler (*Oncideres cingulatus*) which in order to provide its larvæ with the dead wood upon which they feed cuts a deep circular trench around the twigs of hickory and other forest trees below the point at which its eggs have been deposited. The twig dies, falls to the ground and the larva completes its span of life in security.

The species of *Buprestidæ* (q.v.) differ greatly in appearance from the longicorns; but have similar habits. The larvæ are distinguishable by the greatly expanded prothoracic ring immediately following the head, which is very small and retractile. They are always footless. Although the buprestids nearly equal the longicorns in number of species, and exceed them in variety of forms those in our fauna are smaller and because of their plainer colors, much less conspicuous. Many of the tropical species, however, are of great size and brilliant colors and some of their larvæ, which may exceed four inches in length, are eaten. A species very injurious to pear orchards is the sinuate borer (*Agrilus sinuatus*) whose extensive winding galleries in the cambium layer often almost completely sever the bark from the wood and kill the tree. The beetle is about half an inch long and both it and the larvæ are slender. Blackberry canes are often infested by another species (*Agrilus ruficollis*), the larvæ of which excavate irregular passages and cause the formation of gall-like enlargements. The species of *Chrysobothris* form excavations beneath the bark and in the sap-wood of various forest trees, and one species (*C. femorata*) is an orchard pest and another (*C. harrisii*) injures the white pine.

The true bark-borers mostly belong to a family, the *Scolytidæ*, closely related to the weevils (q.v.). They form most elaborate burrows on the inner-surface of the bark, consisting of numerous galleries radiating in all directions from a central chamber. See BARK-BEETLES.

In combating wood-boring beetles the method must be suited to the habits of the particular species, but in general all infected wood should be burned or the larvæ picked out and destroyed. Egg laying should be prevented as far as possible by painting the tree trunks with soap-suds, kerosene emulsion, or similar repellents. Woodpeckers perform a valuable service in the destruction of these larvæ.

Consult Harris and Flint, 'Insects Injurious to Vegetation' (New York 1884); Packard, 'Insects Injurious to Forest and Shade Trees' (Washington 1890); Leconte and Horn, 'Coleoptera of North America' (Washington 1883); Thompson, 'Systema Ceramhycidarum' (Paris 1865).

WOOD CARVING, sculpture in wood, either in low relief or in the round. On the whole the grain and structure of wood make it more suitable for carving in relief than for large statues; some woods without much distinct grain can be carved almost as marble or stone; in other woods the artist must carefully adapt his design to the grain of the wood. Wood used for carving must be carefully seasoned and specially prepared; one method of seasoning it is to soak it, when newly cut, in running water, thus washing away all the sap, and then to dry out the water; an ancient method was to smoke it with wood smoke; still another method is to dry the wood in hot rooms, after pieces of paper have been glued on the ends to prevent the sap from drying out at the ends too rapidly. The woods most commonly used for carving are oak, chestnut, walnut; cedar in ancient times; sandalwood and other perfumed woods in the East; pine, fir and similar soft woods; the last mentioned being especially fitted for carving on a large scale.

History.— Wood carving has occupied an important place in the early development of the fine arts in most nations; although it was almost unknown in Babylonia, Assyria and Persia, it was common in Egypt in early times, in India, in China, and in Japan; and is now practised by many savage and semi-savage races. Particularly the Maori and Polynesian races use an abundance of wood carving, not only on the walls and beams of their dwellings, but also on their paddles, weapons, etc. Their representations of beasts and men are usually grotesque, but they also carve complicated geometrical figures, spirals, etc., of real beauty and freedom of design. The oldest example of wood carving which is now preserved is Egyptian, a life-size statue of a man known as the Sheikh-el-Beled, dating from 4,000 B.C., which gives evidence of marked technical skill; several other smaller pieces of Egyptian carving are also preserved. No specimens of Greek and Roman wood carving have been preserved, but the classical writers leave no doubt that wood was used in the early days of art in both Greece and Rome and many of the sacred statues were undoubtedly of this material. Wood carving reached its highest development in the Middle Ages. The best early specimens of mediæval carving are found in the Scandinavian countries, on several church doorways, dating from the 9th to the 13th centuries; these are carved on pine and the designs consist mostly of interlacing scroll work, combined with figures. The art reached its highest point in France, Germany, England and Italy in the 14th and 15th centuries. The best examples are found in the furnishing of churches, the pulpits, choir stalls, altar screens, etc. The most careful attention to detail, and artistic combination of figures, leaf and scroll work, combined with dignity of design, mark the best mediæval wood carving. Wood was used for the images of saints and for effigies on tombs; and also for larger pieces of carving, such as roofs of churches and other edifices, often richly decorated with figures or foliage designs. In the Renaissance period wood carving was lavishly used in church decoration, choir stalls, confessionals, desks and pulpits; in Italy ceilings were also elaborately carved; but the designs, though elaborate and skilfully worked out, began to lose the dignity of the mediæval carvings, and to indicate a low ebb of taste. In recent times the art of wood carving has lost entirely its former importance. It is best developed among the Swiss peasants, where it is a regularly organized business; and is to some extent preserved among workmen in the provincial towns of France. In Switzerland it is used mostly for clocks, small articles of furniture, toilet articles, etc. In England and the United States wood carving has recently been revived to some extent as a valuable part of art training or of general manual training.

Consult Bond, F., 'Wood-Carving in English Churches' (2 vols., Oxford 1910); Hasluck, P. N., 'Wood Carving' (Philadelphia 1908); Jack, 'Wood Carving, Design and Workmanship' (1903); Maskell, Alfred, 'Wood Sculpture' (London 1911), the best general work on the subject; Lessing, J., 'Holzschnitzerlien des 15 und 16 Jahrhundert' (Berlin 1882); De Lostalot, 'Les arts du bois' (Paris 1893); Ferrari, 'Il legno nell' arte italiana' (Milan); Rowe, Eleanor, 'Practical Wood Carving' (London 1907); Williams, 'History of the Art of Sculpture in Wood' (1835).

WOOD-CHARCOAL, most important, though not the purest, kind of charcoal. Wood consists of carbon, hydrogen and oxygen, the last two being in the proportion to form water. When heated in the open air, it burns completely away, except a small white ash; but if the supply of air be limited, only the more volatile matters burn away and most of the carbon remains. This is the principle of the process of charcoal-burning in countries where wood is abundant. A number of billets of wood are built up vertically in two or three rows into a large conical heap, which is covered over with turf or moistened charcoal-ash, holes being left at the bottom for the air to enter. A hollow space also is left in the middle of the heap to serve as a flue for the gaseous matters which are evolved. The heap is set on fire by throwing burning pieces of wood into the central opening near the top of which a kind of grate made of billets of wood is placed to prevent the burning fuel from falling at once to the bottom. The combustion then proceeds gradually from the top to the bottom, and from the centre to the outside of the heap; and as the central portions burn away, fresh wood is continually thrown in at the top, so as to keep the heap quite full. The appearance of the smoke shows how the combustion is proceeding: When it is going on properly, the smoke is thick and white; if it becomes thin, and especially if a blue flame appears, it is a sign that the wood is burning away too fast and the combustion must then be checked by partially stopping up the holes at the bottom, or by heaping fresh ashes on the top and sides and pressing them down well, so as to diminish the draught. As soon as the combustion is completed, the heap is entirely covered with turf or ashes and left to cool for two or three days. It is then taken to pieces and the portions still hot are cooled by throwing water or sand on them. One hundred parts of wood yield on the average 61 to 65 parts by measure, or 24 parts by weight, of charcoal. (Consult Watts, 'Dictionary of Chemistry.') The charcoal thus prepared is the best suited for fuel. In England a large quantity of charcoal is obtained in the dry distillation of wood in cast-iron cylinders for the preparation of crude acetic acid; the charcoal thus prepared is preferable for making gunpowder, but inferior for other purposes. A peculiar kind of charcoal of reddish-brown color, hence termed *charbon roux*, is prepared in France for manufacture of the gunpowder used in sporting, by subjecting wood in iron cylinders to the action of superheated steam under a pressure of two atmospheres; powder made with this charcoal absorbs moisture more rapidly than ordinary gunpowder.

The general properties of wood-charcoal are that it is black and brittle and retains the form of the wood from which it was derived; it is insoluble in water, infusible and non-volatile in the most intense heat; has power of condensing gases and, from its power of destroying bad odors, it has been regarded as possessing considerable [illegible] properties. It is

frequently stated that charcoal is a poor conductor of heat, but a good conductor of electricity; these properties depend on the nature of the charcoal, the lighter wood, such as willow, yielding a porous charcoal, with little power of conducting heat or electricity; while boxwood yields a very compact charcoal which is a good conductor of heat and electricity. Charcoal never consists entirely of pure carbon, the degree of purity varying directly with the temperature: thus, charcoal charred at 480° contains 65 per cent carbon, while that charred at 750° contains 80, and that charred at 2730° contains 96; but the loss of charcoal occasioned by these high temperatures is very great, the three percentages of charcoal corresponding to these temperatures being 50, 20 and 15.

The uses of wood-charcoal are numerous and extensive. It is very largely used as a fuel, taking in many countries the place of coal. From its being proof against all ordinary chemical agencies, a superficial charring is frequently resorted to for protecting wood from decay, as in the case of piles driven into mud or into the beds of rivers to serve as foundations. For the same purpose, it is a common practice to char the interior of tubs and casks destined to hold liquids. In a finely-divided state it is commonly regarded as an antiseptic; and there is no doubt that the offensive effluvia from animal matter in an advanced stage of putrefaction disappear when the putrefying substance is covered with a layer of charcoal; but in reality the decay goes on without emission of any odor until at length the whole of the carbon is dissipated as carbonic acid gas, and the hydrogen as water, while the nitrogen remains as nitric acid. It has been shown that the action consists in a rapid process of oxidation, dependent on the power which finely divided charcoal possesses of condensing oxygen. In a finely divided state, charcoal not only condenses gases to a marvelous extent, but has the power of absorbing coloring matters, bitter principles, etc.; hence it is of extensive use in the laboratory. From the rapidity of its absorbing action, Stenhouse has proposed to use a respirator filled with charcoal to protect the mouth and nostrils in an infected atmosphere; and the employment of trays of powdered wood-charcoal in dissecting-rooms, in the wards of hospitals and in situations where putrescent animal matter is present, is found to exert a most beneficial influence in sweetening the atmosphere by absorbing and decomposing the offensive gases. These properties render charcoal a valuable material in the construction of filters, not only for decolorizing, but likewise for purifying water for domestic use. It is employed successfully to prevent the escape of noxious vapors at the ventilating openings of sewers, as it allows free passage of air, but condenses the offensive effluvia in its pores where they are destroyed by a process of oxidation. Besides its use in the manufacture of gunpowder it has many applications in the arts. In medicine it is at present used chiefly to destroy fetor, for which purpose it is applied in the form of powder or poultice to gangrenous sores, phagedenic ulcers, etc.; it is also largely employed in tooth-powders, as by its mechanical action it removes incrustations, while by its chemical action it destroys fetor of the breath. In indigestion, accompanied by much flatulence, it may be given in doses of two or three teaspoonfuls suspended in water, or may be administered in the form of charcoal-biscuits. Very finely divided poplar charcoal is regarded as the best for medicinal uses.

WOOD DUCK, or SUMMER DUCK, the most beautiful of American ducks (*Aix sponsa*). The bill is very high at the base, shorter than the head; nail very large and much hooked; head crested; tail short, wedge-shaped. The head and crest are metallic green, glossed on the sides with purple; line through the eye; two bars on side of head meeting under the chin, and upper throat, white; lower neck and sides of tail purple, the former with triangular spots of white; lower parts white; sides yellowish banded with black and posteriorly with white; speculum bluish green, tipped with white; primaries silver white externally at tip; back uniform, with bronzed and green reflections; a white crescent in front of wings bordered with black; scapulæ and inner tertials velvet black with violet gloss. In the female the back is more purplish, the sides of head and neck ashy, about the bill white, and lower neck brownish; the eyes are red. It is 19 inches long and 29 in alar extent. In most parts the plumage is iridiscent with changing metallic reflections.

Formerly the wood duck, one of the most characteristic birds of our fauna, was abundant and widely distributed through the wooded and watered portions of the United States and southern Canada, but as a result of an unholy warfare it has become practically extinct over large areas. It is confined to fresh water, especially secluded ponds in woods. The flight is noiseless, very rapid, graceful and as easy among the branches of trees as that of the wild pigeon. It breeds from April to June, according to latitude, the nest being made in the hollow of a tree, or in the deserted excavations of the woodpecker or squirrel, and usually in deep swamps, though often in the vicinity of houses, for they are not shy birds. The eggs are 6 to 15, 2 by 1½ inches, pale buff and greenish, smooth and laid on dried plants and feathers. They are much attached to the breeding places. The young leap down, or are conveyed to the ground or water by their parents. The adults are excellent divers and feed on acorns, nuts, grapes, berries, rice, insects, snails, tadpoles and small fry. The chief enemies of the adults are minks, raccoons and snakes, and many of the young are destroyed by snapping turtles, alligators and predaceous fishes. It is easily domesticated and readily breeds in captivity. The only other species of the genus is the famous mandarni duck (q.v.) of China. Consult Grinnell, 'American Duck Shooting' (New York 1902).

WOOD ENGRAVING. The art of wood engraving is also known as *xylography*, a distinctly modern term derived from the Greek words *xylos* — wood, and *grapho* — to write, to inscribe. It is the art of producing in relief a reverse or negative of a picture on wood which when inked and impressed on paper or other surface will make a positive of the picture.

If to the art of printing we owe an inestimable debt for bringing to us the record of the thought and history of all times, to the kindred and older art of the wood engraver we owe almost equal obligations. It gave to the cum-

mon people the pictures by which they could be made to understand the purport of written and printed words.

Saint Christopher, the earliest wood engraving, size of original 11¼x8¼. Date 1423

Technique.— While the recent inventions of "process engraving," using photography, labor-saving tools, etc., make the technique of working complicated, the great works of the great masters of wood engraving were done in the very simplest manner. A block of close grained wood (boxwood only is used these days) receives on one side a perfectly smooth and polished surface. Its thickness is .918 of an inch, known as "type-high," or the height of the type along with which it may go into the "form" for the press. The smooth side is next covered with a layer of white chalk (this is known as "grounding") which is better to draw on than the smooth wood surface. On this the drawing is made in negative (the reverse of what is desired in the impression), any lettering, therefore, must read backwards. The work is now done direct on the block by photography, necessitating a sensitized surface instead of the above-mentioned grounding. From the artist or photographer the block goes to the wood engraver, who, using formerly a draw-knife but now a burin, cuts away cleanly to a certain depth all that the artist has left untouched, so that after the work is finished only the drawing remains on the upper surface, and it is in relief. If the finished woodcut be covered with printers' ink and pressed on paper or similar material it gives the imprint of the original drawing. Over and beyond manual dexterity, won by long practice, the wood engraver must also possess a certain degree of artistic temperament as well as being an expert draftsman, even when it is only a question of reproducing the drawing. But, as is the case with many illustrated sheets, there are frequently no lines, but the drawing is in water colors or stumpwork. In such cases the engraver must translate the soft tones of the paintbrush either with his own technique or imitate them exactly (facsimile or tone cut). This latter art is the modern technique of American wood engravers, they being the inventors of it. So great is the difference between the old and the modern methods of producing wood engraving it is necessary to devote a few words to these differences in technique. From the 15th to the 18th centuries and even later the blocks were plank cut, that is to say the upper surface ran with the grain. Pear-tree or apple-tree wood was generally used and it was engraved with the draw-knife. The modern technique uses the cross-cut surface and boxwood exclusively, because it has the most regular texture or fibre. The knife has given way to the burin, used as on copper-plate engraving; the burins are of several forms used each for its separate purpose, whether for engraving outlines, or cross-hatching, or tone effects, etc. Again for a series of straight parallel or curved parallel lines and for the backgrounds of landscapes and portraits special machines have been invented which produce lines or stippling of more refinement and accuracy than is attainable by hand, at the same time greatly increasing the speed of execution. By changes in the process of treatment several new styles of wood engraving have come into being which will be treated of later, such as the criblé, chiaroscuro, "color" styles. An original woodcut permits the taking off of from 6,000 to 10,000 impressions, but to increase its efficiency in the number of prints possible the process of electric deposition of metals has been called into practice and *clichés* reproduce, in metallic relief, the surface engraved on the wood. As there is no limit to the number of *clichés* which can be taken from a single wood block, the number of impressions possible also becomes infinite.

The Grief of Hannah, from the Cologne Bible, about 1475

History.— The date of the actual origin of printing from engravings on wood is still in doubt; it is an involved question. In India stamps engraved on wood have been in use for printing colors on fabrics from a very distant past. Already in the 10th century the Chinese were acquainted with books printed from tablets of wood; and the illuminators of the Middle Ages used wooden embossed stamps for

impressing the outlines of colored initials on manuscripts. The earliest known examples of wood engraving date from the early part of the 15th century when in various parts of northern Europe, notably in Germany and the Netherlands, there existed various rude prints representing scenes from Scripture and the lives of the saints, evidently made from woodcuts. They were printed in a pale brown ink apparently by rubbing on the back of the paper with some blunt edged instrument and were generally colored either by hand or with the use of a stencil.

The Fall of Lucifer, from the Speculum Humanæ Salvationis

One of the most noted of these and the earliest dated print from a wood block is the famous Saint Christopher of 1423 found pasted in the cover of a manuscript discovered in the library of a convent in Buxheim, Swabia. It represents Saint Christopher wading across a stream with the infant Jesus on his shoulder. On the right bank a hermit is kneeling before his cell holding a lantern in his hand, on the left a peasant is climbing a steep hill on the way to his home. It is a rude cut without any regard for perspective, but the figure of Saint Christopher possesses a certain dignity and the pictorial effect is such as would appeal to a primitive people. Many similar cuts were produced in the 15th and 16th centuries in the cities of Augsburg, Nuremberg, Ulm, Cologne and the Flemish cities. Conventional in design and often repeating again and again the same subjects, they were yet expressive of the mediæval religious conceptions and were no doubt highly effective in giving particular and comprehensible value to the biblical lessons they were intended to convey.

It has been contended by some authorities that wood engraving really began with the invention of playing cards, but no authentic records are available of their having been printed before 1423, the date of the Saint Christopher, and they appear to have been made with a stencil. The making of sacred prints very soon developed into a large business, and by the middle of the 15th century wood engraving was an established and widely familiar art. Coming before the invention of the printing press, when books in manuscript only were the treasured possessions of the great monasteries, these prints were of inestimable value in the cause of popular religious education. From the very first wood engraving has been an art for the people. In the beginning serving religious purposes only it soon became a means of satire and comment upon the abuses of the clergy and a record of the manners and customs of the times.

In the early part of the 15th century many minds were striving toward the invention of a way to print from movable types. The idea came no doubt from the so-called block books. Many of the early prints bore the name of a saint or a short legend which was evidently cut on the block with the picture. From these legends it was a natural step to extend the text and add whole columns of text. The date and place of the earliest of these block books is a matter for conjecture, but they were known in the early part of the 15th century. One of the most widely discussed of these is the 'Biblia Pauperum,' or Poor Preacher's Bible, several editions of which are known. It is a small folio containing 40 pages printed on one side only in a pale brownish ink by means of rubbing on the back. Each page is divided into five compartments separated by pillars, suggesting the idea of church windows. The central panel shows a scene from the Gospels and on the sides are illustrations from the Old Testament bearing on the central design. There are also texts and Latin verses. Another block book that has given rise to much speculation is the 'Speculum Humanæ Salvationis,' or 'The Mirror of Human Salvation.' In this the text appears to have been printed from movable type in black ink on a press. It is, therefore, the oldest extant typographical illustrated work known. Other famous block books are the 'Apocalypsis Sancti Johannis,' Visions of Saint John; 'Ars Moriendi,' The Art of Dying; 'Canticum Canticorum,' or a History of the Virgin prefigured in the Song of Solomon. All of these are curiously and often grotesquely mediæval, full of the symbolism and mysticism of primitive humanity. Rude as they are, though, they were preparing the way for something better.

Other noted block books extant are 'Liber Regum,' Book of Kings; 'Temptationis Dæmonis,' Temptations of a Demon; 'Enderist,' the only copy known is in the Spencer Library; 'De Generatione Christi,' of the genealogy of Christ; 'Miribilia Romæ,' The Wonder of Rome; 'Confessionale,' of the Confessional; 'Symbolum Apostolicum,' Symbols of the Apostles.

These German and Netherlands block books were issued in numerous editions and had quite a large foreign circulation. 'Ars Moriendi' was issued in Latin, German, French, Italian and English, the texts varying. Some of these block books were cut up later and pieced together in different combinations in later editions. It must be noted, however, that the engravings done in the Netherlands were, almost invariably, of a more artistic character than those emanating from German hands.

With the advent of printing the block books

were superseded and wood engraving became a handmaid of the greater art. Illustrations are to be found in many of the books of the early printers. The earliest wood engravings in a printed book with an authentic date appear in the Psalter of Faust (or Fust) and Peter Scheffer (or Schaeffer) published at Mayence in 1457. From Cologne, Mayence, Nuremberg, Ulm, Augsburg, Strassburg and Basel came many printed books illustrated with wood engravings.

The Bible was the book on which the early printers spent most of their energies. Numerous editions were published with illustrations. The most important of these was the famous Cologne Bible which appeared before 1475. Its 109 designs were, after the block books, the first illustrations of Scripture, and they showed more originality and invention than anything that had gone before. Many of the decorative borders of this Bible are in curious contrast to the sacred text.

The tendency of the early printers to trade cuts is made clear by the fact that the Nuremberg Bible, published in 1482, contains woodcuts from the Cologne Bible, published between 1470 and 1475. The Augsburg Bible, published about 1475, is a most elaborately illustrated work; Gunther Zainer is said to have been the publisher. With the exception of two, all the 73 woodcuts are placed in combination with initial letters and absorb a full column of space.

Next to the Bibles in interest in the study of wood engraving are the numerous 'Chronicles' and histories. These are records of legends and imaginery events and are illustrated with woodcuts dealing with the lives of the saints and the great happenings in local history. One of the best known of these chronicles is the one published at Nuremberg in 1493. Hartmann Schedel, a Nuremberg physician, compiled the work and it was printed by Anthony Koburger. It has over 2,000 cuts, views of cities, saints, portraits, etc., and is supposed to have been supervised by William Pleydenwurff and Michael Wohlgemuth, the latter a master of the great Dürer. The chief distinction of the Nuremberg Chronicle lies in the fact that in it for the first time woodcuts were printed in simple black and white. They were modern in this respect and in the use of cross-hatching by which grays and blacks of varying intensity were obtained by engraving lines that crossed each other at different intervals.

Another peculiar feature is the fact that the same single cut is used to represent a number of different poets, etc., or one cut suffices to depict views of several cities, etc. This economical method of multiplying the usefulness of a woodcut occurs frequently in contemporary works.

An old style of book of the 15th century also is the figure alphabet, in which the pages are devoted to forming initial letters from figures of all kinds posed in attitudes conforming to the outlines of the capital letters. All these early 15th century books were printed by a rubbing process, either some form of burnisher or roller pressed the paper over the block. The book printing press was not invented till the latter half of the century.

In France wood engraving was early identified with printing. Religious books contained many curious and often beautiful illustrations. Those known as the 'Livres d'Heures,' Books of Hours, often contained many fine examples of carefully executed blocks in imitation of miniatures. Many of these early woodcuts served simply as an outline for the colorist, who often overlaid them with an entirely different design. The first really effective artistic use of the decorative border may be seen in these 'Livres d'Heures,' and some of them are notably quaint

The Ploughman, from the Dance of Death, by Holbein

embodiments of scriptural ideas combined with others that are certainly not to be found in the sacred Book.

At Lyons several books with woodcuts were published about 1476, but the engraving is of the same coarse German grade, till, in 1493, an edition of Terence was issued with illustrations of a more artistic nature. In Paris we find among the publishers of the above-mentioned books of devotion ('Hours'), history, romance and poetry, such names as Jehan Du Pré, Guyot Marchand, Pierre Le Rouge ('La Mer des Histoires,' 1488), Pierre Le Caron, Antoine Verard, etc. Those engravings done by Jean Foucquet and Jean Perreal showed ambitious art work that needed no pigments for embellishment. The books from these publishers found a wide foreign circulation in their Flemish, English and Italian versions. Guyot Marchand's 'Danse Macabre,' Dance of Death (1485), shows most merit in its illustrations. The French brought out a new style, termed by us "criblé," in which the delineation is composed of dots; Renouvier says it was the goldsmiths' manner of engraving and may have been impressed, in some cases, from metal.

England lagged behind other countries in her art development, and wood engraving was little known there before the publication of Caxton's 'Game and Playe of the Chesse' published in 1476 and it is thought that the cuts in this were imported from Germany, and they are too crude for the English to dispute the claim. In Italy the earliest wood engravings were either importations from Germany or were suggested by German originals. The most noted example of early Italian wood engraving is the 'Hypnerotomachia Poliphili,' or Dream of Poliphilo,

written by a Venetian monk in 1467 and printed by the famous Aldus, in Venice, 1499. It contains 192 woodcuts on such subjects as mythology, ancient history, processions, etc. The Italians developed a method of engraving in chiaroscuro, in imitation of painting, by the use of several blocks, each printed in a different color. The Germans also employed the same methods, but in a much cruder form.

With the advent of Albrecht Dürer (1471–1528), of Nuremberg, wood engraving reached its highest attainment. First of all he was a great designer with a far-reaching and powerful imagination and a mind full of the new learning and spirit of the coming Reformation. He was the first fully to realize the great possi-

The Savages of Calient, from the Triumphal Procession by Burgkmair

bilities of wood engraving, and by his influence it was raised to the dignity of a fine art. He is known chiefly by four great works. The first of them the 15 large drawings illustrating the Apocalypse of Saint John (1498). Others are the 'Larger Passion of Our Lord' (1509–11), 12 cuts, 'The Life of the Virgin,' 20 cuts, and the 'Smaller Passion of Our Lord,' 36 cuts. Among Durer's other famous works are the 'Car and Gate of Triumph' made for the Emperor Maximilian. Another great work celebrating the emperor's fame was by Hans Burgkmair (Augsburg, 1472–1531) the magnificent 'Triumphal Procession,' etc. The colossal work entitled 'The Triumph of Maximilian' was made by command of that emperor and consisted of three sets of designs: "The Triumphal Procession,' 'The Triumphal Arch,' and 'The Triumphal Car.' Its size is enormous, the "arch," composed of 92 blocks, when displayed in their correct relative position, is 10½ feet high by 9½ feet wide. While the designs were by Dürer and Burgkmair the execution of the work was by highly talented and enthusiastic wood engravers with Jerome of Nuremberg and Jost de Negker or Dienecker at the head of the list.

Durer's masterly activity in wood engraving gave rise to a school (some of the members were pupils) of decorative designers of great talent who put their conceptions into engravings, forming them into sets, books, etc. These artists are known as the "Little Masters," and their fine work created a general renaissance in the arts of decoration; the jeweler, the potter, the cabinet-maker, all artisans incorporated in their work beautiful decoration taken from the popular designs published and widely circulated all over Europe in these engravings. The best known of these 'little masters' are Beham, Baldung, Aldegrever, Amman, Virgil Solis, etc.

Hans Holbein (1497–1543) ranks among the really great artists and wood engraving owes to him a still further advance. Holbein indeed might be well called the father of modern illustration. Among the first books he illustrated were the 'Utopia' of Sir Thomas Moore and the biblical translations of Luther. He is best known, however, for his remarkable series of designs known as the 'Dance of Death' (1538), a popular subject of mediæval times. In each of the 41 designs is a scene from common daily life expressed with a grim dramatic power and truth of drawing that are remarkable in a very high degree. Death spares neither the king nor the peasant, the praying nun nor the priest in the pulpit. Much of their success was due to the wonderfully accurate wood engraving of Hans Lützelburger, for in the hands of a less skilful engraver the originals would have lost much of their power. Holbein's 86 designs for the Old Testament, generally known as 'Holbein's Bible Cuts,' were also remarkable in many aspects, but they were more conventional in conception. After Holbein, wood engraving as an art steadily declined.

Early in the 16th century either Jost de Negker, German, or Ugo de Carpi, Italian (disputed claims) invented the so-called "chiaroscuro" process by which color effects are gained by using a series of wood blocks each impressed over the other, a separate color being produced by each successive addition. Carpi reproduced several of Raphael's designs by this method, and in Germany were reproduced sheets from the designs of J. Wechtlin, Burgkmair, Cranach, Baldung and others.

A revival, in a modern sense, began with the work of Thomas Bewick (1753–1828) in England. To him we owe the great principle of the white line which did away with much of the old drudgery and gave the engravers more freedom in handling. In the old way, where black lines crossed, the little white lozenges between had to be laboriously cut away. Bewick simply gouged out with his graver a line and by varying the width and number obtained his gradation of light and shade. He was the first also to use boxwood and the burin. Bewick is best known by the drawings and engravings in his 'British Quadrupeds' and 'History of British Birds.' He was the founder of the modern British school which held for many years a distinguished place in modern illustrative art. Bewick's pupils, Charlton Nesbit and Luke Clennell; Robert Branston, John Thompson, the Dalzels, William Harvey and W. J. Linton engraved the work of many distinguished English artists. In France and Germany wood engraving has maintained a distinct place in spite of process work and some of it has been and still is of a very high order of merit. In France a pupil of Bewick's, Charles Thomason, intro-

the value of $13,104,458. For other statistics, see PAPER.

The introduction of this new process was made under many difficulties, the greatest of which was to overcome the prejudice of paper-makers, who believed that rags were the only fit substance to make paper of, and considered wood-pulp as an adulteration or shoddy. At present every newspaper is composed largely of ground wood-pulp, with a small percentage of chemical fibre. Many book, wrapping and other papers also contain a large percentage of ground wood-pulp.

WOOD-QUAIL, or **ROULROUL.** See QUAIL.

WOOD-RAT, a large rat-like wild mouse of the genus *Neotoma*, of which two species dwell in the forests of the southern half of the United States. The body is eight or nine inches long, and the tail nearly as long. The form resembles that of the white-footed mouse (*Microtus*), the animal being more slender and squirrel-like than are the true or house rats, from which this may always be distinguished by his hairy tail, softer fur and much larger ears. The best known species is the Alleghany wood-rat (*N. pennsylvanica*), which is lead-colored above, sprinkled with black hairs, which lightens to yellowish on the flanks and becomes pure white on the abdomen and feet. Consult Goldman, E. A., 'Revision of the Wood Rats of the Genus Neotoma' (in United States Bureau of Biological Survey, 'North American Fauna, No. 31,' Washington, D. C., 1910), and Stone and Cram, 'American Animals' (New York 1902).

WOOD-ROBIN, the wood-thrush (q.v.).

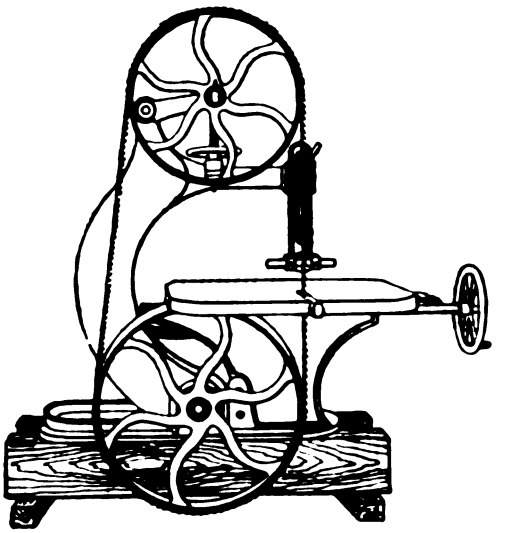
WOOD-THRUSH, or **WOOD-ROBIN,** the most familiar of North American spotted thrushes (*Hylochichla mustelina*), famous for the rich four-parted melody of its spring song. It is numerous in warm weather throughout the Eastern States and Canada, inhabiting the wild spaces as well as confidently approaching the house and roadside. Its nest is often built in a village shade-tree, or even in a garden bush, but more frequently among the forking twigs of an apple tree; and it is to be distinguished from that of the robin by the absence of mud and the presence of many dead leaves, which always form the principal part of its foundation. The eggs are deep blue, smaller and less greenish than those of the robin. It soon becomes unsuspicious of the persons whom it is accustomed to see about the place and who do not disturb it, but is jealous of the attention of other birds, and defends its home with admirable vigor and success. The song, which is heard most frequently and pleasingly toward sunset, is excelled by that of none of the more familiar Eastern birds either in musical quality or in sentiment. It is low, sweet, evenly modulated and flute-like, yet has far-carrying power, and when heard at twilight across the fields, or from unseen recesses of the orchard, it brings to the mind a hymn chanted in praise of the serenity of the summer evening. This thrush is bright cinnamon above, brightest on the head; below white, with large rounded black spots forming lines down in front.

WOOD-WARBLER, a book-name for the small and beautiful American birds of the family *Mniotiltidæ* (see WARBLER); but the name is without special significance, as these birds are not more characteristic of woodland than of other places; nor than other warblers.

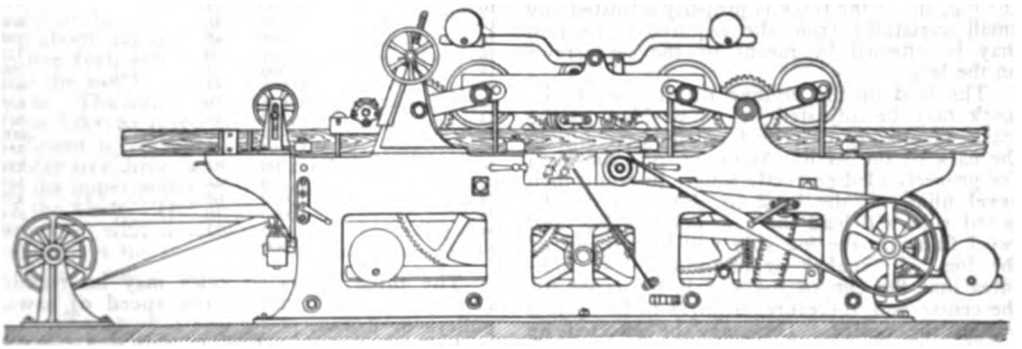
WOOD-WORKING MACHINERY embraces the various machines employed to reduce the timber as cut in the forests into lumber, shingles, doors, sashes, moldings, veneers, barrels, buckets and the endless variety of wooden objects and contrivances used for industrial purposes. As the woods upon which they are used vary in many qualities from the docile white pine to the difficult elm and the almost metallic hardness of the ebony and toughness of the lignum vitæ, their variety and adjustments must be almost numberless. They may be conveniently divided into four general classes — saws, which operate by rending or scission; planers, by which the work is accomplished by a paring action; lathes, in which the wood is turned or pared while being revolved; and grinders or abrading machines, which are generally employed as finishers and accomplish the work through the medium of sand or emery. Saws are blades of steel with toothed edges and though also used to divide metal and stone, they are employed principally to divided wood. (See SAWS AND SAWING; SAW-MILL). For saws used in metal-working see METAL WORKING MACHINERY. The use of saws is of very ancient origin, and it is practically impossible to enumerate in detail their adaptations to various mechanical processes. Among uncivilized peoples, saws were made of flakes of flint imbedded in wooden blades and held in place by means of bitumen. Later, among the ancients, bronze saws were used, but all modern saws are made of steel of the finest quality. Band saws were invented about the beginning of the 19th century, and although their particular merits were known long before the circular saws came into general use, they were not adopted until the latter part of the century, owing to the difficulty of making blades capable of withstanding the severe service. But, with the manufacture of the finer grades of steel of greater tensile strength and elasticity, since 1885, they have been adopted in addition to the circular saws in many of the larger mills. They are made in sizes ranging from one-half inch in width, used for ordinary shop-work, to from six to eight inches in width, for the use of the larger lumber mills. In mode of operation, which is as that of a belt over two pulleys, they cut with a continuous downward motion, with the toothed edge always in the kerf. The pulleys or guide-wheels, one of which is the driver, range from 54 to 72 inches in diameter. The saw blades are in a continuous band, from 45 to 60 feet in length, and the saw is run at a speed of 4,000 feet per minute. Being made extremely thin, they are used for continuous and rapid cutting in planing mills and other wood-working plants, where some cuts have to be made in scrolls and curves, and require a very flexible blade. The thinness of the blade insures a much smaller kerf-waste than that resulting from the circular saw, and as installed in their larger forms in the lumber

The cutters are very ingeniously arranged, and in many cases all four sides of the board are planed down, and the tongue and groove cut in the edges at one operation. The cutters may be so arranged as to produce curved surfaces by following a pattern or model which controls the depth of the cut, and are extensively used in the manufacture of moldings, panels, etc. These machines also cut rebates and grooves and do a limited amount of shaping. They can be run at several different speeds, whichever may be best adapted for the kind of wood being worked. Moldings are, however, usually cut on special machines with upright spindles, the cutter-head only being above the table. Some have two spindles and two cutters, so that both sides of a strip may be modeled at once. They are run at a speed of 5,000 feet per minute.

Mortising machines are of two classes: (1) in which the cutter is chisel-shaped and works with a reciprocating motion; and (2) in which a revolving cutter is used. Large machines of this type, as used in shipbuilding, usually carry a rank of chisels on a single frame, so that several mortises may be cutting at the same time. The blocks to be mortised are adjusted on the feed table so that each chisel cuts its proper chip, and scores for the next chip; each succeeding chisel cutting deeper into the wood. A machine for the ordinary shop, carrying a single chisel, is actuated by a link motion so that each successive blow is deeper than the previous one. Or the depth may be arbitrarily controlled by the foot of the operator on a treadle. Tilting tables enable the mortise to be cut on the bevel if desired. These machines operate at the speed of about 400 strokes per minute. To this class also belong the dovetailing machines in which the cutters are arranged in gangs, similar to a gang of chisels, or revolve upon a vertical spindle. They cut out the tongues and spaces automatically. Wood-working lathes are similar in principle to those employed in metal-working. The piece of wood is held between the stocks of the machine and revolved rapidly, while a chisel or other tool is pressed against it and removes a shaving by a combined paring and severing action. By the use of various automatic duplicating attachments in conjunction with patterns, as in the case of the Blanchard lathe, in which patterns and blanks are revolved together, exact facsimiles are readily obtained, and the output of the machines greatly increased. By these machines such irregular shapes as axe handles, gun stocks and shoe lasts are produced. Other machines involving the lathe principle are the various kinds of borers for drilling holes; tenoning machines and mortising machines for making tenon joints and the mortises to receive the tenons; and gaining machines for cutting grooves. Abrading machines are of two kinds — those in which an endless belt coated with sand or emery is brought in contact with the work, generally of small dimensions; and those in which a drum similarly coated is employed to work down large surfaces. Or they may take the form of simple disks of sandpaper or emery paper glued to a face plate.



Band Saw.

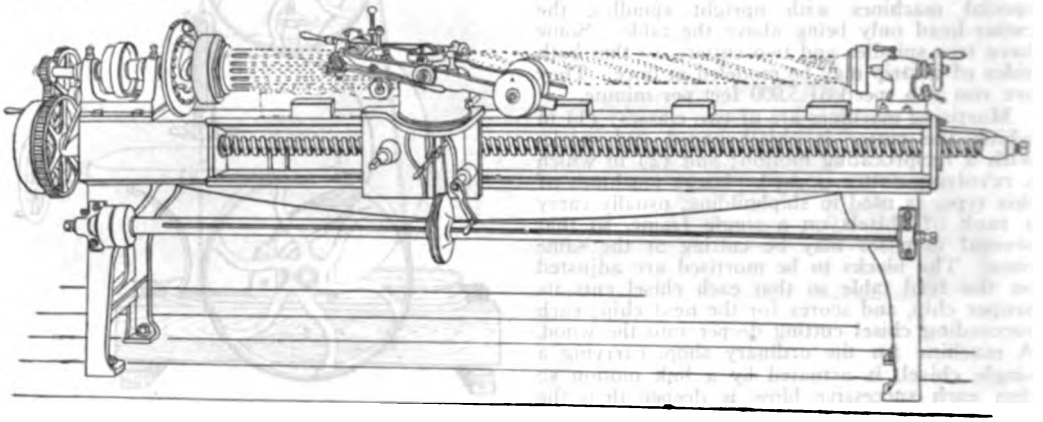


Planer, with Roller-feed.

Practical Suggestions.—The very important place occupied by the circular and band saws among the various classes of wood-working machines demands a few practical suggestions and rules relative to their use, care and management. The principal points to be observed in this connection are as follows:

Hanging the Saw.— Circular saws should always be hung upon the mandrel with the side marked "log side" next to the log on the mill, and should be perfectly plumb when the flanges have been screwed up. Thin saws and saws

driven at high speed should be put up very open in order to allow the centre to pull through. These saws when hung on the mandrel may be concave or convex on the log side when at rest, but when running at the speed for which they are hammered they should straighten up and be flat on the log side. The difficulties resulting from too much crowning or dishing on the log side may be overcome by the use of suitable paper rings placed between the saw and the collars, so that when the saw is clamped between the flanges it will be brought to the proper position.



Copying Lathe.

Lining the Saw with the Track.—The track should be solid, level and straight, and should be put down by careful measurement so as to be from one-eighth to one-quarter of an inch farther from the saw at its centre than at a distance of 20 feet from it. Some saws require more inclination toward the track than others in order to hold them to their work on the log, and if the track is properly adjusted any small variations from the required inclination may be effected by means of the set screws on the box.

The *lead* or the holding of the saw to its work may be adjusted by its position to the track as already described, or by beveling on the back of the teeth. Assuming that the teeth are properly filed perfectly square in front, then bevel filing on the back of the teeth on the board side will lead the saw into the log, and bevel filing on the log side will lead it out of the log. A "snaky" or in-and-out lead indicates that the rim of the saw is too large for the centre and, therefore, requires to be opened out at the centre. This may be effected by running the saw warm at the centre by creating friction, by reducing the set or spread of the teeth, or by hammering between the centre and the rim.

Motion.—The motion of circular saws is one of the conditions which requires the most careful attention. The saw should always be run at a speed approximating as nearly as practicable to a periphery speed of 9,000 feet per minute (in soft woods), and it should be run at a uniform speed both in and out of the cut. Excessively high speeds generate heat in the saw and make it so touchy and limber that it will do good work only on light feed and while the teeth are in the best of condition; but, when the teeth have lost their sharp edge, the saw will dodge whenever it runs against the slightest obstacle. Speeds too low are also objectionable, but they do not produce such ruinous effects upon the saw. These difficulties may be partially remedied by the hammering of the saw, but it is impossible to overcome them completely by such means. The accompanying table gives the proper speed of circular saws of varying diameter. It is calculated on the basis of a periphery speed of 9,000 feet per minute. As a general rule, however, saws for portable mills are usually run at a speed of 450 revolutions per minute, and those for steam feed mills from 600 to 900 revolutions per minute.

TABLE OF SPEED OF CIRCULAR SAWS.

Diameter, inches	Revolutions per minute	Diameter inches	Revolutions per minute
8	4,500	42	870
10	3,600	44	840
12	3,000	46	800
14	2,585	48	750
16	2,222	50	725
18	2,000	52	700
20	1,800	54	675
22	1,636	56	650
24	1,500	58	625
26	1,384	60	600
28	1,285	62	575
30	1,200	64	560
32	1,120	66	545
34	1,050	68	529
36	1,000	70	514
38	950	72	500
40	900		

The three following rules may be readily employed for calculating the speed of saws, pulleys or drums.

1. To find the number of revolutions of the driven when its diameter is known.

Multiply the diameter of the driver by its number of revolutions and divide the product by the diameter of the driven; the quotient will be the number of revolutions of the driven.

2. The diameter and revolution of the driver being given, to find the diameter of the driven that shall make any given number of revolutions in the same time.

Multiply the diameter of the driver by its number of revolutions and divide the product by the number of revolutions of the driven; the quotient will be the diameter of the driven

Studies in American Literature' (4 vols., 1899–1900); Columbia University Studies in Comparative Literature' (9 vols., 1899–1903); 'Bacon's Essays' (1900); Sidney's 'Defense of Poesie' (1908); 'European Years; Letters of an Idle Man' (1911); 'New Letters of an Idle Man' (1913).

WOODBINE, N. J., borough in Cape May County, 48 miles southeast of Philadelphia, Pa., on the Pennsylvania and the Atlantic City Railroads. It is the seat of the Baron de Hirsch Agricultural School. There are garment factories and an iron foundry. Pop. about 2,399.

WOODBRIDGE, Frederick James Eugène, American educator and philosophical scholar: b. Windsor, Ontario, Canada, 26 March 1867. He was graduated at Amherst College in 1889, at the Union Theological Seminary, New York, in 1892, and studied at the University of Berlin in 1892–94. He became a member of the faculty at the University of Minnesota in 1894, and held the chair of philosophy there in 1895–1902. He was appointed professor of philosophy at Columbia University in 1902, became Johnsonian professor of philosophy there in 1904, and since 1912 has also been dean of the faculties of political science, philosophy, pure science and fine arts. He was prominently connected with the neo-realism movement in philosophy. He is editor of the *Journal of Philosophy, Psychology and Scientific Methods*, and of the *Archives of Philosophy;* has contributed to scientific periodicals, and is author of 'The Philosophy of Hobbes' (1903); 'The Purpose of History' (1916).

WOODBRIDGE, William, American politician: b. Norwich, Conn., 20 Aug. 1780; d. 20 Oct. 1861. He removed with his father to Marietta, Ohio, in 1791, but studied law at Litchfield in his native State, and in 1806 was admitted to the Ohio bar, becoming a member of the Ohio assembly the next year. A State senator 1808–14, as well as county attorney, he was appointed secretary of Michigan Territory in 1814, was territorial delegate to Congress 1819–20, and judge of the Supreme Court of the Territory 1828–32. In 1837 he became a State senator, was governor of Michigan 1839–41, and a United States senator 1841–47. Consult Lanman, Charles, 'Life of William Woodbridge' (Washington 1867).

WOODBRIDGE, N. J., township, Middlesex County, on Staten Island Sound, and on the Central New Jersey and the Pennsylvania railroads, about 25 miles southwest of New York. It has regular steamer connection with New York. It has valuable deposits of fireclay, and the chief industrial establishments are brick, tile and drain pipe works. The township contains several villages. It has a high school, established in 1876, public and parish graded schools and a public library. Pop. about 8,948.

WOODBURN, James Albert, American educator and historian: b. Bloomington, Ind., 30 Nov. 1856. He was graduated at the Indiana State University in 1876; taught in the preparatory department of that university from 1878 to 1886; from 1889 to 1890 was Fellow in history at Johns Hopkins University; and since 1890, has been professor of American history in the University of Indiana. He has written 'Higher Education in Indiana' (1890); 'Causes of the American Revolution' in 'Johns Hopkins University Studies' (1891); 'The Historical Significance of the Missouri Compromise, in 'Reports of the American Historical Association' (1893); 'The American Republic and Its Government' (1903); Political Parties and Party Problems in the United States' (1903; rev. ed., 1914); the article 'United States — Political Events of the Civil War,' in the ENCYCLOPEDIA AMERICANA, etc. He has also edited (with Prof. C. W. Hodgin) 'Select Orations of Burke and Webster' (1892); Lecky's 'American Revolution' (from Leckey's 'England in the Eighteenth Century'), with bibliography and notes; 'American Political History' from Prof. Alexander Johnston's articles in Lalor's 'Cyclopedia of Political Science and United States History' (4 vols.), etc.

WOODBURY, Charles Herbert, American artist: b. Lynn, Mass., 14 July 1864. He was graduated at the Massachusetts Institute of Technology in 1886, and studied art in Paris at the Julien Académie under Boulanger and Lefebvre. He later established himself in Boston, where he became well known as a painter of marines. He was elected to the National Academy of Design in 1907; was awarded medals at the expositions held at Paris, Buffalo, Saint Louis and Buenos Aires; received a gold medal at Atlanta in 1905 and a gold medal and medal of honor at San Francisco in 1915. Among his works are 'The North Atlantic (Worcester Museum); 'The Sea' (Indianapolis Art Association); 'The Cliff' (Carnegie Institute, Pittsburgh); 'The Forest'; 'On a Lee Shore,' etc.

WOODBURY, wŭd'bŭr-ĭ, **Daniel Phineas,** American soldier and military engineer: b. New London, N. H., 16 Dec. 1812; d. Key West, Fla., 15 Aug. 1864. He was graduated from West Point in 1836 and was appointed second lieutenant of artillery. He was not long afterward transferred to the engineers and became first lieutenant in July 1838. After service to 1840 in constructing the Cumberland Road in Ohio, he took charge until 1847 of repairing works on the Atlantic Coast. He was in charge of construction at Forts Kearny and Laramie till 1850 and on the North Carolina Coast till 1856. He became captain of engineers 1860, major 6 Aug. 1861, lieutenant-colonel Sept., and brigadier general of volunteers 19 March 1862. At the opening of the Civil War he was assigned for engineer duty in the Army of the Potomac and was active in planning the defenses of Washington. He controlled all the engineering operations in the siege of Yorktown and those before Richmond, and his prompt action at the battle of Fredericksburg in bridging the Rappahannock, won for him the brevet of brigadier-general in the regular army. While in command of the Key West District he died of yellow fever. He published 'Sustaining Walls' (1845); 'Theory of the Arch' (1858).

WOODBURY, Levi, American jurist: b. Francestown, N. H., 22 Dec. 1789; d. Portsmouth, N. H., 7 Sept. 1851. He was graduated at Dartmouth in 1809, studied law, was admitted to the bar in 1812, and practised his profession at Francestown till 1816, when he was elected clerk of the State senate. In 1817 he was appointed a judge of the Superior Court, and

in 1823 he was elected governor of New Hampshire, and in 1825 represented Portsmouth in the State legislature and became speaker of the house. He sat in the United States Senate 1825–31, and on the expiration of his term was elected in March 1831 to the State senate, but declined the offer in order to accept that of Secretary of the Navy, to which he had been appointed by President Jackson. In July 1834 he was transferred to the office of Secretary of the Treasury, which he retained during the remainder of President Jackson's second term of office, and the whole of President Van Buren's administration, retiring on the inauguration of President Harrison 4 March 1841. During this period the post of chief justice of the Superior Court of New Hampshire was offered him, but was declined. In 1841 he was again returned to the United States Senate, but resigned in 1845 on account of his appointment as a justice of the United States Supreme Court, an office which he held until his death. He was a highly influential member of the Democratic party and at the time of his death was considered its most likely Presidential candidate. Consult Capen, N. (ed.), 'Political, Judicial and Literary Writings of Levi Woodbury' (Boston 1852).

WOODBURY, N. J., city, county-seat of Gloucester County, on the Delaware River, and on the West Jersey and Sea Shore (Pennsylvania) Railroad, eight miles south of Philadelphia. The chief industrial establishments are a glass factory, chemical works, piano factory and machine shops. Woodbury ships large quantities of fruit and vegetables. There are several churches, a high school, public and private schools, and the Deptford Institute Free Library. The local banks have a combined capital of over $300,000. Pop. about 4,642.

WOODBURYTYPE PRINTING, a process for obtaining by means of photography a picture or illustration for press printing. This process was invented by W. B. Woodbury, and is the only photo-mechanical one which, in the printing press, realizes the gradations of tone without grain or texture of any kind. The idea of the process emanated from the carbon print, in which the picture is formed in all its gradations by various thicknesses of pigmented gelatine, the shadows, representing the greatest thickness, being in relatively high relief, and the high lights the lowest. Mr. Woodbury conceived the idea of making an electrotype mold of a carbon picture and using the mold so obtained as a printing surface by covering it over with warm pigmented gelatine and by flat pressure attaching a sheet of paper to the pigment, so that when the gelatine jelly was set he could detach it from its mold and thus by repeating the operation obtain unlimited copies. This was practically the Woodburytype; but of course there were difficulties and imperfections, which the inventor quickly set to work to overcome. He found that a thick film of gelatine and bichromate, when exposed under a negative and washed, gave a very high, sharp relief; and he also found that when this relief was perfectly dry it possessed the property of being absolutely incompressible, in other words, it was as hard as steel and could be used as a die. The relief film of gelatine was placed on a block of smooth, hardened steel, with raised edges, upon this was laid a sheet of type metal or lead about a quarter of an inch thick and the arrangement was then placed under a hydraulic press capable of exerting a pressure of about 40 hundredweight to the square inch. The pressure forced the lead into the gelatine image with such accuracy that every shade and detail of the relief was impressed. The raised edges round the steel block prevented the metal from squeezing out and on being detached, a mold in lead was obtained which could be used as a printing surface for thousands of copies. The seemingly delicate relief in gelatine was quite uninjured by this treatment, and would serve for any number of further pressed molds.

The printing press for these pictures is special, resembling the copperplate process in principle. It is formed of a cast-iron base, on which is fitted a movable table to hold the mold, which is bedded down with gutta percha; over the table is a hinged lid, faced with plate-glass, with a lever attachment for giving the pressure. The printing ink is a solution of gelatine in a hot state to which a pigment is added to give any desired tint. In printing, the lead mold is first oiled to prevent the gelatine sticking, and a pool of the warm ink is poured on to the middle of the mold; over this pool is laid a sheet of paper waterproofed with shellac, and the lid of the press is brought down over the whole, and pressure applied. The pressure squeezes out over the edges of the mold all superfluous ink, and all that is left is that retained in the graduated hollows and depressions of the lead mold; the warm ink sets in a few minutes, and on opening the press the paper support is removed with its gelatine copy of the molded picture firmly attached to it.

WOODCHAT, wūd'chat, a bird which, notwithstanding its name, is not a chat, but a shrike, and belongs to the genus *Lanius rutilus*. Its whole length is about seven and one-half inches. The upper parts are mostly black, under parts white, with some white on head, wings and tail; crown of the head and nape of the neck rich chestnut-red. The woodchat is abundant in southern Europe; and it is an African bird, being found from the Mediterranean to the Cape of Good Hope at all seasons of the year.

WOODCHUCK, or GROUND-HOG, an American marmot (*Arctomys* or *Marmota monax*), 18 to 24 inches long, grizzled above and chestnut red below, the feet and tail blackish. It is found from Hudson Bay to South Carolina, and west to the neighborhood of the Rocky Mountains, several distinct sub-species and varieties appearing in this wide range. It digs deep holes in the fields, on sides of hills, or under rocks in the woods, in a slanting direction, at first upward to keep out the water, with several compartments, and usually with more than one entrance. It passes the winter in the burrow, in a dormant state. The digging is effected by the powerful fore feet, assisted by the teeth, the dirt being thrown backward under the belly and then kicked out by the widespreading hind feet. The food consists of various plants, fruits and vegetables; they are especially fond of red clover,

often doing great mischief to this crop and to gardens; another favorite food is celery.

Woodchucks feed chiefly during the early morning and late afternoon and spend most of the remaining time lying in the sun or sleeping in the nests at the bottom of their burrows. They become extremely fat and retire to hibernate on the first intimation of approaching winter and only appear after the snow is gone in the spring. A large brood of young is born in the spring or early summer and when a few months old they are forced to leave the burrow and to shift for themselves. The woodchuck is generally a bold and unsuspecting creature, but has alert senses and where much persecuted may become vigilant. When driven to bay it may fight with considerable courage and effectiveness. Its chief natural enemies are foxes and skunks, but the animal remains generally abundant in both cultivated regions and woodlands in the New England and Middle States. Consult Ingersoll, Ernest, 'Wild Neighbors' (New York 1898); Seton, E. T., 'Life Histories of Northern Animals' (New York 1909); Stone and Cram, 'American Animals' (new ed., ib. 1914).

WOODCOCK, any of several birds, particularly certain snipe-like birds of the family *Scolopacidæ*. The American woodcock, duck snipe, bog-sucker, big-headed snipe, mud snipe, etc., as this bird is variously named by gunners, is the *Philohela minor* of ornithologists. The body is full and robust; the wings short and rounded; the head and eyes very large, and the bill straight; tapering from the stout base, grooved for nearly the entire length and exceedingly sensitive at the end; there is practically no gape; the ear is situated beneath the eye; the legs are very short for a snipe and the tibiæ are fully feathered. The woodcock is 10 or 12 inches long and weighs from seven to nine ounces, the females being the larger. The colors are a soft harmonious blending of various shades of brown and gray, with black mottling above, nearly uniform pale brown below. Except that it invades Ontario and other southern provinces of Canada the woodcock seldoms ventures beyond the limits of the eastern half of the United States at any season. In winter it migrates to the South Atlantic and Gulf States, but most of them breed in the central and northern States. Migration northward begins very early and many of the more hardy individuals reach the Middle and New England States in early March before the frost has left the ground. At such times, and also in the late fall, they secure their food, consisting of insects and their larvæ, snails, etc., by turning over fallen leaves, but during the summer and whenever the ground is sufficiently soft they probe it with their long sensitive bills and with great skill extract the earthworms which constitute their chief food, and of which enormous quantities are consumed. They frequent logs and swampy places along alder-grown streams, hillside springs, etc., during the summer; but in the autumn forsake these coverts for cornfields and the undergrowth of low woods, the surest indication of their presence being their perforations in the soft earth. Few birds are more uncertain in the choice of their feeding grounds, changing from high to low as the weather varies from wet to dry. Their solitary habits are no doubt the result of the character of their favorite food, to obtain which they not infrequently search city lawns after nightfall. As the large size of the eye suggests, the woodcock is crepuscular and nocturnal, the period of its greatest activity being in the hours immediately succeeding sunset and preceding dawn, though, especially when moonlight, it may be abroad throughout the night. During the day it remains hidden in deep bogs and thickets, rising only when forced and then springing perpendicularly above the bushes it flies in an irregular course for a short distance and drops as suddenly to the ground and its concealment.

Mating takes place as soon as the sexes meet in the spring and is followed in April or even earlier by the building of a simple nest of leaves and grass in a dry and well concealed spot in a bog. Four or sometimes five buff or clay-colored eggs variously spotted with dark brown and lilac are laid, and after three weeks of incubation yield the fluffy, brownish-white young, which at once leave the nest led by the old birds to the feeding grounds. The love antics and nuptial flights of the male are curious and interesting. In the former he is a diminutive of a turkey cock; in the latter he mounts in the darkness of night on swift wing high in the air above a wet meadow, then falls like a shot with a whistling sound as the air rushes through his tail and wing-quills. He has also a simple whistling vocal note. The female especially is very solicitous in the care of her young and not only feigns injury in order to entice an intruder from their vicinity, but frequently has been observed to bear them one by one between her thighs to a place of safety. Later in the summer the members of a family scatter to feed singly in their home-bog and with the advance of fall seek the uplands as above described. With the coming of hard frosts most of the woodcock leave for the South and become concentrated in favorite bottoms along the lower Mississippi and other sections of the Gulf States. There and at this time the outrageous practice of fire-hunting is indulged in, chiefly by negroes and market hunters. One person bears a torch which lights the ground and confuses the birds which are often killed in great numbers by a second person with gun or club as they crouch confused on the earth. It is to this practice, as well as to the equally to be condemned spring and early summer shooting still permitted in some of the northern States, that the almost threatened extinction of this fine bird in many parts of the country is to be largely traced. Among natural enemies of the woodcock are minks, hawks, owls, red squirrels, cats and snakes.

Next to the quail the woodcock is probably the most popular game bird of the eastern United States, and deservedly so, but its numbers have greatly decreased since about 1880. To save it all gunners should unite in abolishing spring and summer shooting and in restricting the great destruction which takes place in the Gulf States during the winter by the absolute prohibition of fire-hunting and similar barbarous methods. In every respect fall hunting is the most delightful sport and the birds are then in the best condition for

the table. Most gunners prefer a cocker or other spaniel for flushing the birds from thick coverts and much the same style of gun and ammunition as quail shooting requires. The successful woodcock shooter must be a quick and steady shot, for these birds are as changeable as the Wilson's snipe in their moods, and their coverts offer greater difficulties. When shooting in cornfields the gunner sometimes stands on an elevated platform so that he can overlook the stalks among which his dogs are quartering.

The European woodcock, which occasionally occurs in this country, is a much larger bird and belongs to the genus *Scolopax*, which has long pointed wings, in which the outer primaries are neither much shortened nor attenuated. Its color is a brown of various shades, of darkest hue on the back, while the tail is black above, tipped with gray. Their habits are very similar to those of the American kind. Consult Lewis, 'American Sportsman' (Philadelphia 1868); Fisher, 'Yearbook,' United States Department of Agriculture for 1901.

WOODEN WALL, the side of a ship; hence the ship itself. When Athens was in imminent danger from the Persians 483 B.C., during the invasion of Xerxes, the oracle at Delphi was consulted, and, intimating that the city and country were doomed to ruin, added that — when all was lost, a wooden wall should still shelter her citizens. The Athenian young men interpreted "a wooden wall" to signify ships; Themistocles, who had probably influenced the oracle to utter the prediction or counsel it had given, was of the same opinion; faith was put in the navy and the result was the great victory of Salamis. It was from this incident that the expression, "The wooden walls of England," arose.

WOODFALL, Henry Sampson, English printer and journalist: b. London, 21 June 1739; d. there, 12 Dec. 1805. From about 1758 until 1793, when he disposed of his interest and retired, he conducted the *Public Advertiser*, among the contributors to which was Sir Philip Francis (q.v.). He printed the 'Letters of Junius' (see JUNIUS), which have been conjecturally assigned to Francis. Woodfall, however, is on record as stating that he definitely knew Francis "never wrote a line of Junius." After the Junius letter to the king had appeared in the *Advertiser*, Woodfall was prosecuted for libel by the Crown, but the verdict rendered was practically one of acquittal. In 1797 Woodfall was master of the Stationers' Company. The *Advertiser* ceased to exist in 1795.

WOODFORD, Steward Lyndon, American diplomat: b. New York, 3 Sept. 1835; d. 1913. He was graduated at Columbia in 1854 and admitted to the bar three years later, beginning practice in his native city in 1857. He served in the Federal army 1862–65, being at one period military commandant of Charleston and Savannah, and becoming brevet brigadier-general of volunteers. He was lieutenant-governor of New York 1866–68, but in 1870 as the Republican candidate for governor was defeated. A member of Congress 1873–75, and attorney for the southern district of New York 1877–83, he subsequently engaged in private practice, but was appointed Minister to Spain in 1897, returning to the United States the next year on the opening of the Spanish-American War. He was president of the commission in charge of the Hudson-Fulton Celebration in New York in 1909.

WOODHULL, Alfred Alexander, American brigadier-general: b. Princeton, N. J., 13 April 1837. He was graduated at Princeton, from which he received the degree LL.D. also, and from the University of Pennsylvania as M.D. He served through the Civil War in various medical and surgical offices, and in March 1865 he was brevetted captain, major and lieutenant-colonel "for faithful and meritorious services." He has since filled many other offices in the surgical department of the army, and by Act of 23 April 1904 he was advanced to the rank of brigadier-general, retired. He lectured on personal hygiene and general sanitation at Princeton 1902–07, and has been the author of several medical works, especially 'Military Hygiene' (1890, 1898, 1904, 1909), and 'Personal Hygiene' (1906).

WOODHULL, John Francis, American university professor: b. Westport, N. Y., 2 July 1857. He was graduated at Yale, studied at Johns Hopkins and received Ph.D. from Columbia. He was teacher and principal in secondary schools 1881–85; professor of natural sciences at the New York State Normal School 1887; professor physical sciences, Teachers' College, Columbia, 1888– ; member of the University Council of Columbia 1899–1902. He is a lecturer and author; some of his books being 'Physics' (1900); 'Simple Experiments in Chemistry' (1905); 'Physical Nature Study Library' (1906); 'Electricity and Its Everyday Uses' (1911).

WOODHULL, Maxwell, naval officer: b. New York, 2 April 1813; d. 19 Feb. 1863; only son of the founder of Williamsburgh, Long Island, Richard Miller Woodhull. He entered the navy 4 June 1832, and after service in the Mediterranean, on the coast of Africa, at Brazil, and in the Gulf of Mexico, he engaged in the survey of New York Harbor, made plans for removal of obstructions from Hell Gate, and executed surveys on the New England Coast. In the Civil War, with rank of commander, 1 July 1861, he organized the supply service for the blockading fleet, commanded a division of the James River flotilla in the Peninsular campaign, was later attached to Admiral Wilkes' flying squadron in Florida waters, and after being ordered North was accidentally killed.

WOODLAND, Cal., city, county-seat of Yolo County, on the Southern Pacific Railroad, about 85 miles northeast of San Francisco, and 18 miles north of Sacramento. It is in an agricultural region, in which wheat and grapes are among the chief products. Many sheep are raised in Yolo County. The chief industries are connected with raising and shipping grapes, and shipping wheat, fruit, barley, wool and livestock. The educational institutions are Holy Rosary Academy (Roman Catholic), Hesperian College (Disciples of Christ), opened in 1861, a high school established in 1895, graded elementary public and parish schools and a public library. The city has several

banks with deposits amounting to about $2,000,000. The commission form of government is in operation. Pop. about 3,187.

WOODLAND AREA OF THE UNITED STATES. See LUMBER INDUSTRY OF THE UNITED STATES.

WOODMEN OF AMERICA, Modern, a fraternal beneficiary society instituted at Lyons, Iowa, 5 Jan. 1883, by Joseph Cullen Root, who served as its president until November 1890. It affords life insurance to its members and pays to the designated beneficiary on the death of a member the amount designated in the certificate or policy held, the maximum being $3,000. Available statistics indicate a membership of 1,082,255; benefits disbursed since organization, $210,251,048.53; benefits disbursed in a recent fiscal year, $14,750,000. The society maintains a sanatorium for the treatment of tuberculosis. The head consul's office is at Lincoln, Neb.; the head clerk's office at Rock Island, Ill. The recognized women's auxiliary of the Modern Woodmen of America is the Royal Neighbors of America, which has a membership of about 375,000.

WOODMEN OF THE WORLD, Sovereign Camp. The Sovereign Camp of the Woodmen of the World was organized in Omaha, June 1890, by the founder, Joseph Cullen Root, in conjunction with John T. Yates, B. W. Jewell, F. F. Roose, F. A. Falkenburg and W. O. Rodgers. The Woodmen of the World, Sovereign Jurisdiction, includes all of the United States except the eight States on the Pacific Coast. It is a beneficiary society affording life insurance to members thereof and has a membership approximating 1,000,000, carrying $1,263,547,700 insurance and erects a monument at the grave of every member; provides 70-year old benefits and has a juvenile class insurance. The Woodmen Circle is the recognized women's auxiliary of this order and has a membership of 225,649. The headquarters of the society are located at Omaha, Neb., where they have erected an 18-story office building, costing $1,500,000, the institution occupying the greater part of the building for headquarters.

WOODPECKER, a bird of the family *Picidæ*, one of the most sharply defined families of birds which, with the related *Picumnidæ* and *Iyngidæ* form the natural order *Pici*. These birds have a unique type of bony palate (saurognathous) especially characterized by the separation of the vomer into a pair of splint-bones; the fourth toe is reversed permanently so that it forms a pair with the hallux, which, however, is occasionally absent. The *Picidæ* are distinguished by the acute, rigid and bristly character of the tips of the five well-developed pairs of tail-quills, the outer or sixth pair being rudimentary. In typical woodpeckers the head is large, the neck slender but very powerful, the bill stout, straight, chisel-pointed, and often strengthened by longitudinal ridges, the nostrils protected by a thick screen of bristly feathers, and the feet very powerful, with short stout tarsi, strongly hooked claws and rough scales. The tongue is slender and flexible, with a barbed, hard tip in most cases, and the posterior hyoid "horns" curving up over the rear of the skull into sheaths of muscle. This tongue is provided with muscles for projecting it far beyond the tip of the bill. This arrangement enables these birds to explore deep recesses for insects, and even to drag larvæ from their burrows by means of the barbed tip and the adhesive secretion which the tongue receives from the greatly developed salivary glands.

The woodpeckers are a large group, 45 genera and 350 species having been enumerated in 1890. Except Australian, Madagascar and certain groups of the Polynesian Islands they inhabit the forest-clad regions of the entire globe. Their food, which consists to a great extent of the long-lived wood-boring larvæ, makes them largely independent of seasons, and they are, with some exceptions, little migratory and are equally at home in far northern and tropical forests. A few woodpeckers, like *Colaptes* (see FLICKER), robin-like, search for worms and insects on the ground, and these have weaker, slightly curved rounded bills and smaller heads. Some, as the sapsuckers (*Sphyrapicus*), drill the outer bark of rosaceous trees and lap the flowing sap with their bristle-brushed tongues or, like the redhead woodpecker, peck the ripest apples, green corn and other sweet and succulent vegetables. But the great majority are strictly insectivorous and perform an invaluable service to human kind by their enormous destruction of a class of pernicious insects largely beyond artificial attack. In searching for insects woodpeckers usually begin at the very base of a tree trunk, move spirally upward supported by their strong feet and bracket-like tail, peering into every crevice, pausing occasionally to tap the bark, then remain in an attitude of apparent intense listening and move on. From time to time they peck the bark with hammer-like blows delivered with intense energy, which make the chips fly rapidly and soon expose the larva whose presence within had apparently been detected by the bird's keen sense of hearing. As soon as one tree is sufficiently explored they go to another, but often spend a long time searching and drilling a decayed limb or stump much infested with insects. Woodpeckers have a very characteristic undulating or galloping flight which is seldom much protracted. Their nests are in holes drilled by themselves first horizontally then vertically downward and chambered in the usually partially decayed limb or bole of a tree or some suitable substitute. The eggs are always white with a highly polished porcelain-like surface, are usually numerous, and are deposited on a few wood chips at the bottom of the excavation. Woodpeckers are unmusical, their nuptial song being a loud harsh rattling cry or laugh, combined with a loud drumming on resonant branches. Except during the nesting season they are usually silent and solitary birds.

About one-half of the known woodpeckers are American and eight genera and 30 species and sub-species enter the United States, a number of racial forms being confined to the extreme Southwest. As their habits conform pretty closely to the account just given, only a few representative forms need be mentioned

two terms and fathered the "personal registration" amendment to the Pennsylvania Constitution. In 1906 he was appointed president of the board of personal registration commissioners for Philadelphia. He later served as secretary of the National Municipal League, and in 1917 he was appointed to the advisory committee of the National Council of Defense. He edited the *Proceedings* of the National Conference for Good City Government in 1894–1911, and is editor of the *National Municipal Review*. He has published 'City Government by Commission' (1911).

WOODRUFF, Wilford, American Mormon leader: b. Northington (now Avon), Conn., 1 March 1807; d. Salt Lake City, Utah, 3 Sept. 1898. He adopted the Mormon faith in 1833 and in subsequent years made missionary tours to England, and in the eastern States. He was one of the Mormon emigrants to Salt Lake City; became one of the 12 apostles in 1839; and in 1887 was elected president of the Mormon Church. For 22 years he held a seat in the Utah legislature.

WOODRUFF, wŭd'rŭf, or **WOODROOF,** plant of the genus *Asperula* and natural order *Rubicaceæ*, with whorled leaves, native of northern parts of the old world, and distinguished by a funnel-shaped or bell-shaped corolla, a bifid style, capitate stigma, and dry didymous fruit. The sweet woodruff (*A. odorata*) is common in shady woods in all parts of Europe. It has a creeping root, a stem five to 10 inches long, weak and sub-erect, four or five whorls of lanceolate leaves, six to eight in the whorl rough at the edge and keel, and small white flowers. The plant when dried has a very agreeable fragrance, similar to that of *Anthoxanthum odoratum* under similar circumstances. It forms an agreeable herb-tea, and enters into the composition of the popular *Maydrink* of the Germans. Dyer's Woodruff (*A. tinctoria*) is a native of the continent of Europe and of Siberia, a perennial, with reclining stems about 12 inches long, whorls of six or four linear leaves, upper leaves opposite, flowers whitish. The root is used in Dalmatia and elsewhere instead of madder; but the crop obtained from a field is inferior in quantity to that of madder. For flavoring, the Germans in this country use the sweet-scented bedstraw (*Galium triflorum*), of the same family, and with odor much like that of woodruff; it is procumbent, the fruit bur-like, with hooked bristles, the flowers in threes, greenish; it is common in woods that have a rich soil.

WOODS, Charles Robert, American soldier: b. Newark, Ohio, 19 Feb. 1827; d there, 26 Feb. 1885. He was graduated at the United States Military Academy in 1852 and was engaged in garrison and frontier service until 1861. He commanded the troops on the steamer *Star of the West*, in the attempt to relieve Fort Sumter in April 1861, and was appointed colonel of the 76th Ohio volunteers 13 Oct. 1861. He saw service at Fort Donaldson, at Shiloh, the siege of Corinth and in the Vicksburg campaign, and was promoted brigadier-general of volunteers 4 Aug. 1863. He commanded a brigade at Lookout Mountain and Mission Ridge and a division in the Georgia and Carolina campaigns. He was mustered out of the volunteer service 1 Sept. 1866, with brevet rank of major-general in the regular army and was transferred to the regular army. He was later engaged in the Indian warfare of the western plains. He was appointed colonel of the Second infantry 23 March 1874 and was retired from service in December 1874.

WOODS, Frederick Adams, American biologist: b. Boston, Mass., 29 Jan. 1873. He studied at the Massachusetts Institute of Technology in 1890–94 and took the degree of M.D at Harvard University in 1898. He was connected with the faculty of the Harvard Medical School in 1898–1903, and since 1903 has been lecturer on biology at the Massachusetts Institute of Technology. He has published many papers on heredity and the volumes 'Mental and Moral Heredity of Royalty' (1906); 'The Influence of Monarchs' (1913), and is joint author of 'Is War Diminishing?' (1915).

WOODS, Katherine Pearson, American novelist: b. Wheeling, W. Va., 28 Jan. 1853. She was educated in private schools in Baltimore. During 1893–94 she held a fellowship under the College Settlement Association and published the report of investigations during that period in the *American Journal of Statistics* (December 1895.) She engaged in missionary work among the whites of North Carolina from 1903–06. Her published works include 'Metzerott Shoemaker'; 'Mark of the Beast'; 'A Web of Gold'; 'From Dusk to Dawn'; 'A Tale of King Messiah'; 'The Son of Ingar'; 'The True Story of Captain John Smith'; and many magazine articles.

WOODS, Leonard, American Congregational clergyman: b. Princeton, Mass., 19 June 1774; d. Andover, Mass., 24 Aug. 1854. Graduated at Harvard in 1796, he studied theology at Somers, Conn., as a pupil of Dr. Charles Backus, in 1798 was ordained pastor of the church at Newbury, Mass., and upon the establishment of the Andover Theological Seminary in 1808 was made professor of Christian theology there. In 1846 he retired from the active duties of the chair. He was a strict Calvinist, well-versed in metaphysical studies, a clear and vigorous writer and a champion of the New England theology against Ware, Buckminster, Channing and other Unitarians. "He is emphatically," says H. P. Smith, "the 'judicious' divine of the later New England theology." He was prominent in the founding of the Temperance Society, the American Tract Society, and the Board of Commissioners of Foreign Missions. Among his works are 'Life of Mrs. Harriet Newell' (1814); 'Letters to Unitarians' (1820); 'Lectures on the Inspiration of the Scriptures' (1829); 'Letters to the Rev. N. W. Taylor' (1830); 'Memoirs of American Missionaries' (1833); 'Examination of the Doctrine of Perfection' (1841) and 'Lectures on Church Government' (1845); 'Theology of the Puritans' (1851). Consult Foster, F. H., 'A Genetic History of New England Theology' (Chicago 1907), and Walker, Williston, 'Ten New England Leaders' (New York 1901).

WOODS, Leonard, American theologian and college president, son of Leonard Woods

1774–1854 (q.v.): b. Newbury, Mass., 24 Nov. 1807; d. Boston, Mass., 24 Dec. 1878. He was graduated at Union College in 1827 and at the Andover Theological Seminary in 1830. He was professor of sacred literature at Bangor Seminary in 1836–39, and in 1839–66 he was president of Bowdoin College. He edited the *Literary and Theological Review*, New York, in 1834–37; translated G. C. Knapp's 'Christian Theology' (2 vols., 1831–33), and was author of many valuable papers on the early history of Maine, contributed to the *Proceedings* of the Maine Historical Society.

WOODS, Robert Archey, American university settlement worker: b. Pittsburgh, Pa., 9 Dec. 1865. He was graduated at Amherst in 1886, and from Andover Theological Seminary in 1890, and made a European tour for the purpose of investigating social problems, spending six months at Toynbee Hall, London, and has been head of the South End House, a university settlement in Boston, since 1891. He lectured on social economics at Andover Theological Seminary (1890–95), and on social ethics at the Episcopal Theological School, Cambridge (1896–1914). In 1911 he became secretary of the National Federation of Settlements, and he was president of the National Conference of Social Work (1917–18). He is the author of 'English Social Movements' (1891); edited 'The City Wilderness' (1898); 'Americans in Process' (1902); and was joint editor of 'Handbook of Settlements' (1911); 'Young Working Girls' (1913).

WOODS, William Burnham, American jurist: b. Newark, Ohio, 3 Aug. 1824; d. Washington, D. C., 14 May 1887. He was graduated at Yale in 1845, was admitted to the Ohio bar in 1847, and was mayor of his native city in 1856–57. In the last-named year he was elected to the Ohio legislature and chosen speaker, at the outbreak of the Civil War entered the Union army as lieutenant-colonel of the 76th Ohio regiment, and was promoted brevet major-general, serving under Grant and Sherman. At the close of the war he took up his residence in Alabama, was chosen chancellor of that State in 1868, appointed circuit judge of the Fifth District in 1870, and in 1880 became an associate justice of the United States Supreme Court.

WOOD'S HOLL, or WOOD'S HOLE, Mass., in the town of Falmouth (q.v.), in Barnstable County, on Buzzards Bay, and on the New York, New Haven and Hartford Railroad. It has a large, deep harbor, and is widely known as the location of a station with a marine laboratory of the United States Fish Commission.

WOODSFIELD, Ohio, village and county-seat of Monroe County, 100 miles southeast of Columbus, and on the Ohio River and Western Railroad. It is situated in an oil region, has machine shops and several small manufacturing industries. Pop. about 2,502.

WOODSTOCK, Canada, the county-seat of Carleton County, New Brunswick, charmingly situated on the left bank of the Saint John River, and on the Canadian Pacific Railway, 66 miles from Fredericton. The industries include sawmills, tanneries, foundries, woodworking shops, etc. Pop. about 3,856.

WOODSTOCK, Conn., town in Windham County, about 40 miles northeast of Hartford and five miles northwest of Putnam. It contains six villages. The town is in an agricultural and stock-raising region. The chief industrial establishments are creameries and cotton twine factories. It has Woodstock Academy, graded schools and a public library. Woodstock belonged to Massachusetts when it was incorporated in 1690. In 1749 it was annexed to Connecticut. Pop. about 1,849.

WOODSTOCK, Ill., city and county-seat of McHenry County, on the Chicago and Northwestern Railroad, about 50 miles northwest of Chicago and 30 miles east of Rockford. It is in an agricultural and dairying section. It has flour and lumber mills, a creamery, typewriter works, planing mills, machine shops, pickle and canning works. The principal public buildings are the county courthouse, city hall and business blocks. It has several churches, the Todd Seminary for boys, the Chicago Industrial Home for Children, the Old Folks Rest Home, an armory, a high school, established in 1867, public elementary schools and a public library. Pop. about 4,331.

WOODSTOCK, Vt., town and county-seat of Windsor County, on the Ottaguechee River, and on the Woodstock Railroad, 38 miles south of Montpelier and 30 miles east of Rutland. It is in an agricultural and dairying region, and contains four villages. The chief industrial establishments are butter and cheese factories, sash, door and blind factories, flour and lumber mills. Other manufactures are hay-rakes, sleighs, wagons, carriages, butter tubs and cheese boxes. The town has several churches, graded grammar and elementary schools, and the Norman Williams Public Library, founded in 1885. Pop. about 2,545.

WOODSTOCK, Va., town and county-seat of Shenandoah County, on the north branch of the Shenandoah River, and on the Baltimore and Ohio Railroad, about 95 miles west of Washington, D. C., and 155 miles northwest of Richmond. It was founded in 1762. It is in an agricultural and stock-raising region, and its industries are connected chiefly with farm and dairy products and the marketing of livestock. It has several churches and graded schools for both races. Pop. about 1,200.

WOODSTOCK, a novel by Sir Walter Scott, published in 1826. It is an English tale of the time of Cromwell; the events occurring in the year 1652, immediately after the battle of Worcester. The scene is laid chiefly in the Royal Park and Manor of Woodstock.

WOODWARD, Calvin Milton, American educator: b. Fitchburg, Mass., 25 Aug. 1837; d. Saint Louis, Mo., 12 Jan. 1914. He was graduated at Harvard University in 1860 and was principal of Brown High School, Newburyport, Mass. (1860–65). During one year of the Civil War he was captain of Company A, 48th Massachusetts Volunteers, serving in Louisiana. In 1865 he was called to Washington University, Saint Louis; elected professor of mathematics and applied sciences (1870); dean of the school of engineering (1871–96) and was founder and director of the Saint Louis Manual Training School since its organization in 1879. Dr. Woodward's service to the cause

of education was marked by success along practical lines. He served as a member of the Saint Louis School Board (1877–79) and again after 1897; regent of the Missouri State University (1891–97) and in 1906 president of the American Association for the Advancement of Science. In 1909–10 he was also president of the North Central Association of Colleges and Secondary Schools; president of the Society for the Promotion of Engineering Education and was re-elected dean of the School of Engineering and Architecture (1901). In 1905 Washington University conferred upon him the degree of LL.D., and in 1908 he received the same honor from the University of Wisconsin. He contributed many valuable articles to educational and scientific journals and wrote 'History of the St. Louis Bridge' (1881); 'The Manual Training School' (1887); 'Manual Training in Education' (1890), etc. In the summer of 1910 he retired from the deanship and the last four years of his life were devoted to works of philanthropy and to the authorship and publication of his book upon 'Rational and Applied Mechanics.'

WOODWARD, Robert Simpson, American astronomer, physicist and mathematician: b. Rochester, Mich., 21 July 1849. He was graduated with the degree of C.E. at the University of Michigan 1872 and was appointed assistant engineer, United States Lake Survey. During 1882–84 he served as assistant astronomer to the United States Transit of Venus Commission; from 1884–90 he was astronomer, geographer and chief geographer to the United States Geological Survey, became assistant in the United States Coast and Geodetic Survey in 1890, and served for three years. From 1893–1905 he was professor of mechanics and mathematical physics at Columbia University, and from 1895 to 1905 was dean of the faculty of pure science. In 1905 he became president of Carnegie Institution, Washington, D. C. Dr. Woodward was president of the American Mathematical Society 1898–1900, American Association for the Advancement of Science 1900–01, New York Academy of Sciences 1900–02. In 1892 he received the degree of doctor of philosophy from the University of Michigan, and in 1904 the degree of doctor of laws from the University of Wisconsin. He has published many papers and addresses on astronomy, geodesy, mathematics and other scientific subjects. (See article EARTH in this Encyclopedia). He has written 'Smithsonian Geographical Tables' (1894); 'Higher Mathematics — a Text Book for Classical and Engineering Colleges' (1896 with Mansfield Merriman), etc.

WOODWARD, Okla., city and county-seat of Woodward County, on the North Canadian River, 130 miles northwest of Oklahoma City, and on the Atchison, Topeka and Santa Fé and the Wichita and Northwestern railroads. A government agricultural experiment station is located here. There are a Carnegie library, Federal building, courthouse and school. The city is a shipping centre for wheat, corn, livestock and poultry. Pop. about 2,000.

WOODWORTH, Robert Sessions, American psychologist and physiologist: b. Belchertown, Mass., 17 Oct 1869. He was graduated at Amherst College in 1891, received the degree of A.M. at Harvard University in 1897, and that of Ph.D. at Columbia University in 1899, and later studied at the universities of Edinburgh, Liverpool and Bonn. He was demonstrator in physiology at the University of Liverpool in 1902–03, and was subsequently connected with the faculty of Columbia University, where since 1909 he has been professor of psychology. He was president of the American Psychological Association in 1914. He is joint author of 'The Elements of Physiological Psychology' (1911), and author of 'The Accuracy of Voluntary Movement' (1899); 'The Care of the Body' (1912); 'Dynamic Psychology' (1917), etc.

WOODWORTH, wŭd'wĕrth, **Samuel,** American author and editor: b. Scituate, Mass., 13 Jan. 1785; d. New York, 9 Dec. 1842. He received a limited education in his native town, and was apprenticed in Boston to Benjamin Russell, editor and publisher of the *Columbian Sentinel*. After the expiration of his indentures he published for a brief period at New Haven, Conn., the Weekly *Belles Lettres Repository*, and engaged in other literary pursuits, in which he continued with more or less success until the close of his life. He was one of the founders in 1823, in conjunction with George P. Morris, of the *New York Mirror*, from which he withdrew within a year. Among his writings were a number of dramatic pieces, and 'Champions of Freedom,' a romance of the War of 1812 (1816), but his reputation rests principally upon his songs and miscellaneous poems, one of which, 'The Old Oaken Bucket,' obtained a wide popularity. His collected poems were published by his son, with a memoir by George P. Morris (2 vols., 1861).

WOOF. See WEAVING.

WOOL, wŭl, **John Ellis,** American general: b. Newburgh, N. Y., 20 Feb. 1789; d. Troy, N. Y., 10 Nov. 1869. He was in early life proprietor of a bookstore in Troy, and his property being consumed by fire, he turned to the law, but his studies were interrupted by the war with Great Britain in 1812, when he became captain in the 13th infantry. He distinguished himself at Queenstown Heights, Plattsburgh and Beekmantown, and in 1816 was appointed inspector-general of the northern division; in 1818 lieutenant-colonel; in 1821 inspector-general of the whole army; and in 1826 brevet brigadier-general for 10 years' faithful service. In 1832 the government sent him to Europe to examine the military systems of some of the principal nations. In 1836 he was charged with removing the Cherokee Indians to Arkansas, and in 1838, during the Canadian difficulties, made a reconnoissance through the wilds of northern Maine, with a view to the defense of the frontier. He was appointed brigadier-general, 25 June 1841, and at the beginning of the Mexican War was ordered to the West to organize the volunteers, 30 May 1846, and in less than six weeks dispatched to the seat of war with 12,000 troops fully armed and equipped. He selected the ground on which was fought the battle of Buena Vista, 23 Feb. 1847, commanded in the early part of the action, and for his conduct on this occasion was brevetted a major-general in 1848. After his return home in July 1848, he commanded the

eastern military division, with headquarters at Troy, until October 1853, when he was placed at the head of the department of the East, with the headquarters at Baltimore. From 1854 to 1857 he was in command of the department of the Pacific and of the Eastern department again in 1857-60. When civil war was imminent toward the close of 1860, he offered his services to the government, and after the attack upon Fort Sumter went to New York to organize, equip and send to Washington the first regiment of volunteers. In August he was sent to Fortress Monroe as commander of the department of Virginia, and from that post led an expedition which occupied Norfolk, 10 May 1862. He was promoted to be full major-general in the regular army, 16 May 1862 and the next year was placed on the retired list.

WOOL. Wool is the soft elastic fiber which is grown on the domestic sheep. It so closely resembles the longer hairy fibres growing on the Llama, Alpaca, Angora and Cashmere goats that these fibres are imported under the name wool for commercial reasons.

Wool is shorn from the sheep ordinarily once each year; however, there are some sections in which it is thought desirable on account of continued hot weather to shear twice each year. The shearing season varies with climatic conditions but generally speaking it occurs early in the spring. In those sections where shearing is done twice each year, it is done in the spring and fall. Most of the sheep in the large wool-producing sections of the world are shorn by machine clippers. The remainder are shorn by hand shears or "blades." Skilful shearers can shear very rapidly, sometimes with machine clippers handling more than 200 sheep in a day of 10 hours.

The average shearer will probably shear 150 sheep each day. With the hand shears or "blades" the number would be somewhat smaller. The amount of wool obtained from each sheep varies with the breed and the section from which it is obtained. Ordinarily from 3 to 12 pounds of wool are obtained from each sheep. An average fleece might be said to weigh from five to eight pounds.

According to the Bradford system of manufacture, wools are classed as "combing" or "clothing." A wool, to be combing, must be at least two and one-half inches in length, while wools shorter than that are used for carding and are termed "clothing." There is a third class called "carpet wools," which includes the very coarse wools and inferior wools not well adapted to the finer class of goods for which the first two classes are used. Carpet wools are, however, either carded or combed. The introduction of the French comb has made it possible to comb wools of a shorter length than heretofore and many of the wools formerly used for carding or clothing are now combed with this comb and are known as "baby combing." Another possible system of classifying wools divides them into four groups which take into account the breed of sheep and gives better defined divisions than the system mentioned above. These groups are: (1) Merino wool; (2) British wool; (3) Crossbred wool; (4) Carpet wool. The breed of the sheep has a direct influence on the character of the wool and this fact makes such a system especially desirable for classifying fleece wools.

There are more than 200 different breeds of sheep in the world, representing all grades of wool, from the finest to the coarsest. The entire wool production of the world for the year 1917 was 2,790,472,220 pounds. Of this total the distribution is as follows: Europe, 793,400,043; Australia, 741,802,000; South America, 470,120,707; United States, 285,573,000; Asia, 273,146,000; Africa, 207,680,470, and a remaining 18,750,000, of which 11,400,000 is from British provinces of North America, 6,500,000 from Mexico, 750,000 from Central America and the West Indies, with 100,000 pounds from small oceanic countries not included under any of the above classifications.

Carpet wools as the name implies are generally used in making carpets, Oriental rugs and also more or less in the coarser grades of clothing. For the most part they come from Asia and southeastern Europe. The crossbred wools from South America, South Africa, New Zealand and Australia have a considerable variation in grade and a wide range of uses. The British wools are from sheep of English blood and are divided according to the character of the wool into long and medium wools. The long wools are noted for their lustre and are classified in the trade as lustrous and semi- or demi-lustrous, being used for fancy-dress goods, linings and braids where the lustre of the material is an important consideration. The medium wools are much finer than the long wools and were until recently used for woolens. Now with the improved combing machinery and the introduction of the French combs they are used for either woolens or worsteds. They come mostly from Great Britain and British provinces and the United States. Merino wools are our finest wools and are used for materials of very fine texture, either woolens or worsteds. These wools are produced in Continental Europe, Australia, South Africa, South America and the United States.

The wools of the United States are divided into two groups, territory and domestic. The territory wools, sometimes called "range" or "western," are those grown under range conditions as found in Wyoming, Montana, Idaho, Nevada, Utah, Arizona, New Mexico, Colorado and other States where the same conditions prevail. The domestic wools are those grown under farming conditions and are often spoken of as "farm," "eastern" or fleece wools.

Sheep in sections producing territory wools are exposed to all kinds of weather on the range and are seldom protected from storms, for which reason the wool is often harsh and contains more dirt and foreign matter than the domestic wools. Often the fleeces are composed of very weak fibres or fibres that are weak at some one point in their length. The domestic wools on the other hand are usually strong and are more free from dirt and, therefore, have a smaller shrinkage. They are protected from inclement weather and are given more care and attention than the territory wools.

It has been stated above that there is a large variation in the quality of wools from the different countries. There is a difference in the quality of wools from different breeds of

sheep, and indeed there is a variation in the wool on different parts of the same animal. This variation in wools makes it necessary to classify them according to their qualities. Wools are generally separated out according to the grades of the different fleeces, either at the time of shearing or at the wool warehouses. When this work is done at the shearing shed it is sometimes called classing, while at the warehouse it is called grading. The most progressive wool-growing centres of the world class and bale their wool at the time it is shorn, others ship it to the warehouse where it is graded and baled. Though much advancement has been made in the Western States in the past five years in the manner of handling wool, there is still much room for improvement. There is considerable difference in the terms used in classing and grading wool throughout the world. The terms most widely used are those of the topmakers' system. They classify wools according to fineness or coarseness in terms of spinning counts; a spinning count referring to the number of hanks of worsted yarn that a pound of a given grade of wool will spin. For example, a lot of wool classed as 60s would spin 60 times 560 yards, or 33,600 yards of worsted yarn. The terms used in the American system, "Boston Terms," were originally based on the proportion of Merino blood a sheep producing the given wool possessed. The pure-blood Merinos, having the finest wool, were used as the standard. These terms are still retained but no longer carry their original significance, as any one of a large number of different breeds might easily produce a half-blood wool

The terms "staple" or "combing" and "clothing" are often added to the grade names to distinguish them. Both the staple or combing and the clothing of a given grade are the same fineness, but the combing wools are generally used for the manufacture of worsteds, while the clothing is used in the manufacture of woolens.

Pulled wool or skin wool is wool that is obtained from the pelts of sheep that have been slaughtered or have died from disease or exposure. It is generally inferior to shorn wool obtained from live sheep. This is due to the methods of obtaining it. The skin is treated chemically or submitted to a special treatment which loosens the roots of the fibres. The wool is then pulled out by hand much as the bristles are removed from a hog after scalding. During the year 1917 there were 40,000,000 pounds of pulled wool produced in the United States. In addition to the pulled wools from the United States there are large wool-pulling establishments in practically all the large wool-producing centres. Mazumet in France is the largest wool-pulling centre in the world.

FIG. 1. — Shearing wool in Wyoming.

The following table shows the American grades, together with the corresponding topmakers' terms:

American terms	Topmakers' quality terms
Fine and fine medium	64s-70s
Half-blood	58s-60s
Three eighths-blood	50s-56s
Quarter-blood	46s-50s
Low quarter-blood	40s-44s
Common or braid	36s-40s

The Wool Fibre.— The wool fibre as has been stated above is the hair-like covering growing on the skin of the sheep. Each fibre is similar to hair in its method of growth. The appearance presented by a cross-section of a hair follicle under the microscope is shown in Fig. 2.

The skin of the sheep is composed of four layers, an outer or scarf, which is composed mostly of dead cells; the epidermis, or true

skin; a papillary layer filled with minute blood vessels, and finally the dermis or corium. Projecting through this skin are innumerable so-called hair follicles or sack-like bodies. Each wool fibre is formed in one of these follicles and grows from it. As the fibre is pushed out through the skin it is rather plastic, but on coming to the surface it soon hardens. The wool fibre is composed of three parts. In the centre is the medulla composed of soft globular cells. This medulla is well defined in the coarser fibres but in the finer grades of wool is seldom visible even under the most powerful microscope. Next surrounding the medulla are spindle-shaped cells which make up the largest part of the fibre known as corticle, while on the outer part are the horny scale-like cells. These cells surround the outer part of the fibre scales, projecting somewhat from the body of the fibre and overlapping much like the shingles on a roof. These scales are very important for it is the scales upon the wool fibre that produce what are known as serrations and give the wool fibre its property of felting, a property possessed by no other fibre to such a marked degree. The serrations are most numerous, acute and pointed, in fine-wooled sheep such as Merinos. In Saxony Merino for example as many as 2,800 have been counted in one inch. This surface or epidermal layer of scales gives the wool its lustrous quality. The fibre with smooth flatly lying scales is generally very lustrous. This is well shown in some of our hairy, long-wooled sheep such as the Leicester and Lincoln. These have fewer serrations, there being about 1,800

Fig. 2.—Drawing showing cross-section of a hair follicle.

per inch. Some of the coarse inferior wools do not exceed 500 serrations per inch. There is also much difference in the size of the individual fibre. The finest Merino wools will vary from 1/2000 to 1/4000 of an inch, while a maximum diameter of 1/250 of an inch is obtained in the coarsest wools.

The crimp or curliness is an important property of wool fibres, since it plays a large part in the spinning of yarn and the felting of cloth. The curly fibres will spin finer and make a better thread than the straighter ones. In spinning, the fibres interlock with their serrations and the crimp or curliness helps to keep them from untwisting. They also give to cloth made from them a much better felting property, although this property is due only in part to the curliness of the fibres. The serrations or scales, as stated above, play the most important part. There seems to be a definite relation between the curliness and fineness of the wool fibre. The curliness and waviness are noted points in the judging of wool.

Wool, even the finest, has a high tensile strength and the fibre is strong throughout its length. Sometimes tender wool results from

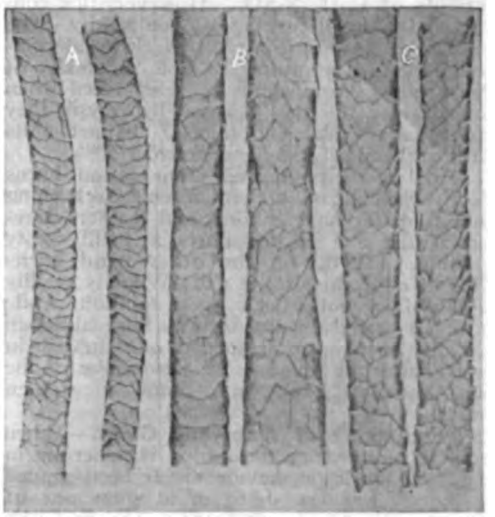


Fig. 3.—A, Merino wool fibres; B, Lincoln wool fibres; C, Leicester wool fibres.

the lack of proper foods, severe climatic conditions or sickness. This is wool having a weak spot at some point in its length. Dead fibres are sometimes found on poorly-bred sheep and are known as "kemps" and referred to as kempy wool. Dead or weak fibres are highly undesirable as they will not stand the strain which fibres must undergo in spinning, but will break instead of stretching.

The elasticity of wool is one of its most important qualities, giving to wool its soft feel and to the finished cloth its characteristic pliability and softness. Many of the finer wools will stretch 35 per cent of their length without breaking. There are many shades of wool found throughout the world, including black, white, brown, fawn, yellow and gray shades. White is by far the prevailing color. The colored wools are made use of in the spinning, knitting and weaving of rough yarns, knitted shawls and tweeds.

From a chemical standpoint wool is a highly complex substance. There are three components which go to make up the raw wool. All wool in its natural state contains a fatty or greasy matter called yolk. This is secreted from the skin and covers the fibres. It serves to lubricate the fibres, prevents their matting together and protects them during growth, and protects the fleece to a great degree against injury by outside agencies. It is a natural

impurity of the wool. There is also the wool fat which permeates both the yolk and the fibre, and the wool fibre, which is really a more complex chemical compound than either the yolk or the wool fat.

According to Hummel, the composition of the average wool is as follows: Moisture, 4–24 per cent; yolk, 12–47 per cent; dirt, 3–24 per cent; wool fibre, 15–72 per cent.

According to Bowman, the composition of the wool fibre is as follows: Carbon, 50.8; hydrogen, 7.2; nitrogen, 18.5; oxygen, 21.2; sulphur, 23.0.

It is said to have a probable empirical formula of $C_{45}H_{69}N_{13}SO_{16}$. However, this conveys but a small idea of its complexity. The wool fibre belongs to a class of chemical compounds known as proteins. The complexity of this group of compounds is clearly seen when we consider the fact that on hydrolysis they are usually broken up into 17 distinct units known chemically as amino acids.

Wool as distinguished from cotton burns slowly with an odor characteristic of burning animal matter such as horns and feathers, leaving at the end of the fibres a small crusty globule. Cotton on the other hand burns without odor to a white ash. Wool is readily dissolved by hot caustic soda solution, while cotton is practically unaffected. This, although a simple test, is an important one for use in determining the presence of cotton, one of the most common adulterants found in woolen goods.

Manufacture of Wool into Cloth.— When wool is received at the mill, it is generally in a graded condition, having either been graded at the shed where shorn or at some one of the numerous wool warehouses. The first step in the preparation of the wool at the mill is to remove the string and open up the fleece and tear out all hard paint which will not scour out when the fleece is cleaned. The fleece is then spread on a table, the centre of which is covered with a wire netting. This allows the sand and dirt to pass readily to the floor. The sorters tear the fleece apart, separating it into piles according to its different qualities. As a rule the best wool is obtained from the shoulder and sides. That from the forepart is irregular and sometimes filled with burrs, while the loin wool is shorter and coarser. The wool from the britch and hind quarters is the coarsest, while the wool from the under side of the throat is liable to be short, worn and dirty. The wool on the shoulder is finest and superior in soundness of fibre, softness of curl and evenness of length.

After the wool is sorted it is next passed through a machine called a duster, which not only removes much sand, dirt and dust, but opens up the wool and better prepares it for the next operation, the scouring.

After the wool passes from the duster, the first operation is to scour it to remove the dirt and grease, thereby obtaining the pure wool fibre. This operation consists in passing the wool through three or four vats or bowls which contain a cleaning solution of hot soapy water. Each vat has its own set of rollers which squeeze out the washing solution from the wool before it passes on to the next vat. In this way the wool is gradually cleaned and on passing through the rollers of the last vat is propelled by means of a chain elevator to the dryer. The dryer is a specially constructed chamber kept very hot by means of steam. Most of the moisture is removed from the wool while in the dryer.

When wool contains burrs, chaff and similar vegetable matter it must pass through a special treatment. When the wool is very burry it is passed through what is known as the carbonizing process. This consists of dipping it in a bath of aluminum chloride or sulphuric acid solution, extracting the moisture and heating the wool to 212° F., when the vegetable matter is reduced to a powder and may be readily shaken or blown from the wool. Wools having comparatively few burrs are ordinarily only run through the machine known as the burr-picker, which removes the burrs mechanically by tearing them from the wool. Sometimes when quite burry it is found more satisfactory to run the wool first through the burr-picker to remove larger burrs and then to carbonize it to remove all the fine seeds and such material as is not entirely removed by the burr-picker.

The wool is now ready for the next operation, known as carding. None of the operations up to this point has made an attempt to straighten the fibres, but all have left them in a more or less tangled condition. The purpose of carding is to open the fibres so that they lie loosely separated in a uniform film, and to eliminate remaining impurities and fibres too short to spin. In the manufacture of woolens the rotary cards are used. These cards consist of rollers in the surface of which there is a large number of wires. These rollers revolving in opposite directions cause the wool as it is passed between them to be opened, separated and straightened. The fibres are usually carded three times by being passed successively through three cards known as scribbler, intermediate and finishing card. From the first two the fibres come out in the form of a filmy lap. From the third, this product goes to a condensing machine, where it is divided and comes out in light strands about one-eighth of an inch in diameter. These strands, known as rovings, are wound onto spools and are now ready for the spinning room.

The next operation is the spinning of the yarn. This consists of drawing out the roving and twisting it into yarn. Up to this stage the wool has received no twisting, but has held itself together by the binding action of the scales on the wool, and their natural curliness or crimp. The spinning is for the most part done on a machine known as a mule and is in four successive steps which are practically automatic. Mule spun yarns are soft and rather loosely spun. Another kind of spinning is known as frame spinning. The frame spinning requires less space and labor for its operation. However, frame-spun yarns are not so soft as those produced on the mule. After the yarn is spun, it is used singly or twisted together into two, three or four strands, depending upon the coarseness or fineness of the fabric into which it is to be made. The yarn is now ready for the weave room, where it will be woven into cloth.

2,446,219 pounds of foreign mohair; 6,619,750 pounds of camel, alpaca and vicuna hair; and 28,136,636 pounds of other animal hair. Rags and clippings yielded 62,083,016 pounds, and wool recovered from other materials, 30,158,915 pounds. Yarns purchased in foreign countries totaled 214,455,204 pounds, divided thus: woolen yarn, 23,802,234 pounds; worsted yarn, 62,895,372 pounds; merino yarn, 706,483 pounds. Silk yarns were used to the extent of 706,483 pounds; cotton yarns, 56,988,329 pounds; linen yarns, 7,611,078 pounds; and yarns of jute, ramie, and other vegetable fibre in the amount of 61,653,015 pounds. The cotton, linen, jute, and other vegetable yarns were used almost exclusively by the carpet and rug industry.

Closely associated with the wool manufacturing industry are the wool shoddy and the wool pulling industries. Shoddy is the trade name given to wool recovered by tearing apart soft woolen rags. It is of the class of short staple, and while it is not as durable as new wool, it provides a very large amount of material suitable for cheap garments, blankets, etc. The wool shoddy industry according to the census was carried on by 64 establishments employing a capital of $6,420,985, and 2,145 hands, and producing a yearly output valued at $7,706,843. The wool pulling factories reduce waste yarn to fibre which may be recarded, spun and woven. In 1914 there were 34 such establishments with a combined capital of $3,534,203. They employed 708 hands, and their annual output was valued at $8,272,721.

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WOOL-GRASS, a rush. See SCIRPUS.

WOOL-SORTERS' DISEASE. See ANTHRAX.

WOOLF, wŭlf, **Albert Edward,** American chemist and inventor, son of Edward Woolf (q.v.): b. New York, 26 Sept. 1846. He was educated in the College of the City of New York. Among his discoveries are the antiseptic and medical properties of seawater combined with the electric current, and the use of electrically decomposed seawater for sanitary purposes, used in many large cities in treatment of drinking water, sewage and garbage, and adopted by the United States government to combat the yellow fever epidemic in Cuba; the use of peroxide of hydrogen to bleach black ostrich feathers white, and also its employment as an antiseptic. He also modeled the bronze medallion of General Grant, now at the former home of the general at Mount McGregor.

WOOLF, Benjamin Edward, American dramatist and musician: b. London, 16 Feb. 1836; d. Boston, Mass., 7 Feb. 1901. Coming to New York in childhood with his parents, he early displayed a passion for music and was carefully trained by his father, with such results that in later days he became leader of orchestras in Boston, Philadelphia and New Orleans. He settled in Boston, where he was dramatic critic for the *Saturday Evening Gazette* 1871–93, a post which he quitted for a similar one on the Boston *Herald*. He was an industrious musical composer, writing many overtures, quintets and trios, besides plays and operettas. His most successful comedy was 'The Mighty Dollar,' while his operetta, 'The Doctor of Alcantara,' was a favorite in its time.

WOOLLETT, wŭl'ĕt, **William,** English engraver: b. Maidstone, Kent, 15 Aug. 1735; d. London, 23 May 1785. His family originally came from Holland, and he was instructed in his art by an engraver named John Tinney. He engraved historical subjects and portraits, but was most successful in landscapes, in which he exhibited such varied excellences, as in the opinion of Longhi, to entitle him to be considered "the marvel and the example for all contemporary engravers and for those of the present time." His foregrounds are vigorous and solid, and his aerial perspective wonderfully clear and true, while he treats water, the crux of the engraver, with supreme success. His masterpieces are his 'Niobe' and other plates after pictures by Richard Wilson, and the 'Death of Wolfe' and the 'Battle of La Hogue' after West. He was the first who conceived and embodied in practice the idea of uniting in one plate the three methods of engraving, by aqua fortis, the burin, and the dry needle. His genuine plates are estimated at 123, but impressions are exceedingly rare and valuable, as he permitted no imperfect prints to be struck off. Consult Fagan, Louis, 'Catalogue Raisonné of the Engraved Works of William Woollett' (1885).

WOOLLEY, wŭl'ĭ, **Celia Parker,** American Unitarian minister: b. Toledo, Ohio, 14 June 1848. Graduated from Coldwater Female Seminary, in 1868 she was married to J. H. Woolley, and in 1876 removed to Chicago. She was pastor of the Unitarian Church, Geneva, Ill., for three years, and of the Independent Liberal Church, Chicago (1896–98), since when she has been active as a lecturer and in the work of women's clubs. She is the author of the novels 'Love and Theology' (1887), republished as 'Rachel Armstrong, or, Love and Theology'; 'A Girl Graduate' (1889); 'Roger Hunt' (1893); 'The Western Slope' (1903).

WOOLLEY, John Granville, American prohibitionist: b. Collinsville, Ohio, 15 Feb. 1850. Graduated from the Ohio Wesleyan University in 1871, he was admitted to the bar of the Illinois Supreme Court in 1873, became city attorney of Paris, Ill., in 1875, prosecuting attorney in Minneapolis in 1881, and practised at New York, 1886. At one period addicted to intemperance, he began lecturing against it in 1888, and has lectured to many audi-

Princeton, was tutor at Yale, 1823–25, and was licensed to preach in 1825. After studying abroad (1827–30) he was professor of Greek at Yale 1831–46, and president of the college 1846–71. In 1871–81 he was chairman of the American company of revisers of the New Testament. Besides editions of Greek plays — the 'Alcestis' of Euripides (1833), the 'Antigone' (1835) and 'Electra' (1837) of Sophocles, the 'Prometheus' of Plato (1837), as well as the 'Georgias' of Plato (1842) — his works include an 'Introduction to the Study of International Law' (1860; 5th ed. 1879); 'Essays on Divorce and Divorce Legislation' (1869); 'Political Science; or the State Theoretically and Practically Considered' (1877); 'Religion of the Past and of the Future' (1871); 'Communism and Socialism' (1880); 'Helpful Thoughts for Young Men' (1882). He also edited Lieber's 'Civil Liberty and Self-Government' (1871), and his 'Manual of Political Ethics' (1871). He was one of the founders of the *New Englander*, to which he often contributed, one of the regents of the Smithsonian Institution, and at one period president of the American Oriental Association. Woolsey Hall of Yale University was named in his memory.

WOOLSEY, Theodore Salisbury, American professor of international law, son of T. D. Woolsey (q.v.): b. New Haven, Conn., 22 Oct. 1852. He was graduated from Yale in 1872, became instructor in international law at Yale in 1877, and since 1878 has been full professor there. He has published 'America's Foreign Policy,' and edited Pomeroy's 'International Law' (1886); and the 6th edition of Woolsey's 'International Law' (1891). He was also associate editor of Johnson's 'Universal Cyclopedia' (1892–95); and editor of the *American Journal of International Law*. He received the degree of LL.D. from Brown University in 1903.

WOOLSON, Constance Fenimore, American author: b. Claremont, N. H., 5 March 1848; d. Venice, Italy, 24 Jan. 1894. Educated in Cleveland, Ohio, and New York, she resided in Ohio, then in Florida and other Southern States, and finally abroad, chiefly in Italy. Her first story published in a secular magazine — contributions to Episcopalian periodicals had preceded it — was 'The Happy Valley' in *Harper's Monthly* (1870). In this much of her subsequent work appeared. Many poems were printed from time to time, but these were never collected. Her reputation was based on works of fiction, the volumes being 'The Old Stone House' (1873); 'Castle Nowhere: Lake Country Sketches' (1875); 'Rodman the Keeper' (1880); 'Anne' (1882); 'For the Major' (1883); 'East Angels' (1886); 'Jupiter Lights' (1889); 'Horace Chase' (1894), and 'The Front Yard, and Other Italian Stories' (1895). Their background is generally American, preferably the Lake region or the South; and when it shifts to Europe is less skilfully treated. They were highly praised by Stedman and other critics for equal freedom in presenting diverse types and conformity to high literary standards.

WOOLSTON, wul'ston, **Thomas,** English deist: b. Northampton, 1669; d. London, 21 Jan. 1731. He was educated at Sidney Sussex College, Cambridge, became a Fellow, and took orders in the English Church. He made a careful study of Origen, and in 1705 published the 'Old Apology for the Truth of the Christian Religion against the Jews and Gentiles Revived.' He maintained in this work that Moses was an allegorical personage, and his history typical of that of Christ. In 1721 he published 'The Moderator between an Infidel and an Apostate,' dialogues tending to show that the Gospel miracles by themselves could not prove Christ to be the Messiah. This work occasioned great scandal, and it was only through the intervention of Whiston that the author escaped a prosecution. In 1721 his college deprived him of his fellowship. The views set forth in his last work Woolston developed more fully in 'The Moderator between an Infidel and an Apostate' (1725). His famous series of six 'Discourses on the Miracles of Christ' appeared 1727–29, with two 'Defences' in 1729 and 1730. He was indicted for blasphemy in consequence of the publication of this work and was imprisoned 28 Nov. 1729. His collected works with 'Life' appeared in five volumes (1733). See DEISM, and consult Cairns, J., 'Unbelief in the Eighteenth Century' (1880), and Sayons, 'Les Déistes anglais' (1882).

WOOLWICH, wŭl'ich, England, a municipal and parliamentary borough of London, in Kent, eight miles below London Bridge. Area, 8,277 acres. It has many ancient, together with a number of handsome modern houses, an old church (restored 1894), other places of worship, a town hall and several charitable endowments. It owes its importance to the royal arsenal, which occupies an area of above 350 acres, and is one of the most complete and magnificent establishments of the kind in the world, with extensive forges, foundries and workshops of various kinds in which the newest types of machinery are employed for the manufacture of immense quantities of warlike stores which are kept in suitable magazines and storehouses. Woolwich Dockyard, for centuries the most important in the kingdom, having become unsuitable for modern requirements, was made over to the War Office in 1872. In the Rotunda there is a fine historical collection of arms and other interesting objects. A large garrison is stationed at Woolwich, which is the headquarters of the royal artillery; and there are various barracks, a military and a naval hospital, etc. On the edge of Woolwich Common, a fine large open area, are the handsome buildings of the Royal Military Academy (see MILITARY SCHOOLS); and the Royal Ordnance College is also at Woolwich. At North Woolwich, on the opposite side of the river, to which runs a free steam ferry, many houses and extensive factories, especially of telegraph cables, have recently sprung up. The borough returns one member to Parliament. Pop. 121,376. Consult Larking, 'The Domesday Book of Kent' (1869); Vincent, 'Records of Woolwich' (1890).

WOOLWORTH, Frank W., American merchant: b. Rodman, N. Y., 13 April 1852; d. Glen Cove, L. I., 9 April 1919. He received

a public and commercial school education, and in 1879 established a "five cent store" at Utica, N. Y., removing the business to Lancaster, Pa., later in that year. Out of the business grew a great chain of about 1,000 "five and ten cent stores" in the United States and Canada, and about 75 in England. The business was organized under the firm name of Frank W. Woolworth and Company, of which Woolworth was president. He amassed a great fortune, and was a director in various banks and trust companies. He also built in New York the famous tower "skyscraper" known as the Woolworth Building, 57 stories high and of beautiful design.

WOONSOCKET, woon-sŏk'ĕt, R. I., city in Providence County, on the Blackstone River, and on the New York, New Haven and Hartford (two branches) Railroad, about 15 miles northwest of Providence and 37 miles southwest of Boston. It has electric lines extending to all the near-by towns. The river here is spanned by a bridge which cost originally $300,000. It has three parks and the county fair grounds. It is a well-known manufacturing city. The chief manufactures are cotton goods, foundry and machine-shop products, worsted goods and hosiery and knit goods, rubber boots and shoes and wringing machines. Other manufactures are carved and turned wood, wagons, carriages, woolen goods, machinery and furniture. The educational institutions are a high school, established in 1857; Sacred Heart College (Roman Catholic) for young men; Saint Ann's Academy (Roman Catholic) for girls and young women, public and parish schools, the Harris Institute Library containing about 16,000 volumes. There are several banks and trust companies. The city owns and operates the waterworks. Woonsocket is a consolidation of several factory villages. The first village called Woonsocket is not included in the limits of the present city. The city was set off in 1867 from the town of Cumberland; in 1871 a part of Smithfield was annexed, and 13 June 1888 the city was incorporated. Pop. 40,075. Consult Richardson, 'History of Woonsocket' (Woonsocket 1876).

WOORARI, or WOORARA. See CURARI.

WOOSTER, wus'tĕr, **David,** American Revolutionary general; b. Stratford, Conn., 2 March 1710; d. Danbury, Conn., 2 May 1777. He was graduated at Yale College in 1738, and in 1739, when the war broke out between England and Spain, entered the provincial army as lieutenant, and was subsequently made captain of a vessel built and equipped by the colony for defense of its coasts. In 1745 he participated in the expedition against Louisburg, and went in command of a cartel ship to England, where he was made a captain in the regular service under Sir William Pepperell. In the French War which ended in 1763 he was commissioned by the governor of Connecticut as colonel, and subsequently as brigadier-general, and served during the whole war. In April 1775 he was one of the members of the assembly of Connecticut who concerted the plan for the seizure of Ticonderoga; and when the continental army was organized he was appointed one of the eight brigadier-generals. He was engaged in the expedition into Canada, where after the death of General Montgomery he for a time held the chief command. He resigned and returned to Connecticut, and was major-general of the militia when Tryon invaded that province for the purpose of destroying the military stores at Danbury. He attacked Tryon's rear guard 27 April 1777, and while rallying his men was mortally wounded. On 17 June Congress voted that a monument should be erected to his memory, but no steps were taken to have the resolution carried into effect, and his neglected grave was not identified until 1854, on 27 April of which year the cornerstone of a monument to his memory was laid, by act of the legislature of Connecticut. The town of Wooster, Ohio, was named in his honor.

WOOSTER, Ohio, city and county-seat of Wayne County, on the Killbuck Creek, and on the Pennsylvania and the Baltimore and Ohio railroads, about 50 miles southwest of Cleveland. It is in an agricultural and stock-raising region. It has manufactories of flour, furniture, doors, sash and blinds, boilers, engines, aluminum ware, pumps, brushes, farm implements, pianos, glass, mill-gearing, and brick. There are banks having a combined capital of over $200,000. The educational institutions are Wooster University, the Ohio Agricultural Experiment Station, a high school, public elementary schools, and libraries. Pop. about 6,136.

WOOSTER, College of, located at Wooster, Ohio, was founded under the auspices of the Presbyterian Church, chartered in 1866 and first opened in 1870. In 1890 the charter was revised and the power of electing the members of the board of trustees delegated to the Presbyterian Synod of Ohio. Previously the board was self-perpetuating. In 1914 the name of the institution was changed from "The University of Wooster" to "The College of Wooster." It is a coeducational non-sectarian institution.

The organization of the college now consists of the collegiate department, the Bible and missionary training school and the conservatory of music. The college offers two baccalaureate degrees, bachelor of arts and bachelor of science. It has always stood for a high grade of scholarship, being a member of the North Central Association of Colleges. On a beautiful campus of 100 acres on a hilltop overlooking the city of Wooster are the 12 modern and fully equipped college buildings. The prevailing style of architecture is the English Collegiate-Gothic. Splendid athletic facilities are furnished by the large gymnasium and a 14-acre stadium given to the college by the late L. H. Severance of New York. A unit of the Students' Army Training Corps was established in 1918. The faculty consists of 41 members. The college has over 2,000 alumni, and represents an investment in buildings and endowment of over $2,000,000. Its aim is to provide a liberal and thorough education embracing physical, mental and moral development.

WORCESTER, Dean Conant, American educator; b. Thetford, Vt., 1 Oct 1866. He was graduated at the University of Michigan in 1889, having previously accompanied the

Steere scientific expedition to the Philippine Islands in 1887–89. He was instructor in animal morphology at the University of Michigan 1893–96, becoming assistant professor in the last-named year. In 1890–92 he again traveled in the Philippines, with F. S. Bourns, in a tour known as 'The Menage Scientific Expedition,' and in January 1899 was appointed one of the United States commissioners to the islands to investigate and report on conditions there. He was the only member of this commission to be appointed on the second or Taft commission, which returned to the Philippines in 1900, and established civil government there. He was Secretary of the Interior of the Philippines (1901–13). He has published 'Preliminary Notes on Birds and Mammals collected by the Menage Scientific Expedition to the Philippine Islands' (1894); 'Contributions to Philippine Ornithology' (1898); 'The Philippine Islands and their People' (1898); 'The Philippines, Past and Present' (1914); and numerous articles on the 'Wild Tribes of the Islands,' which were under his executive control for 12 years.

WORCESTER, Edward Somerset, 2D MARQUIS OF, English inventor: b. Raglan Castle, Monmouthshire, 1601; d. 3 April 1667. He engaged in the service of Charles I during the Civil War, and was employed by the king to act for him in Ireland; but when his errand was discovered he was treated with duplicity by Charles, and retired to France in 1648. Returning to England in 1652 he was imprisoned in the Tower 1652–54, and his estates were seized, but after the Restoration he recovered most of these. He afterward spent his time in retirement, and in the cultivation of natural philosophy and mechanics. In 1663 he published a book entitled 'Century of the Names and Scantlings of Inventions as I can call to mind to have been Tried and Perfected,' in which he first gave a description of the uses and effects of an engine for "driving up water by fire"; and afterward published a small pamphlet, called 'An Exact and True Definition of the most Stupendous Water-commanding Engine, invented by the Marquess of Worcester.' In neither of these does he give any statement of the mode of constructing his engine; but, from his description and account of its effects, it may be inferred that its action depended on the condensation as well as the elastic force of the steam. (See STEAM-ENGINE). Consult Dircks, Henry, 'Life, Times, and Scientific Labors of the Second Marquis of Worcester,' London (1865); Dircks, 'Worcesteriana' (1865).

WORCESTER, Edwin Dean, American railway official: b. Albany, N. Y., 19 Nov. 1828; d. New York, 13 June 1904. He studied law, and followed various pursuits, but entered railroading in 1853, when he became a member of the accounting department of the New York Central Railway. He laid out, opened and managed the books of this company when there were no precedents in the United States for the organization of large railways, and the present accounting system of railways in this country is largely the development of his work. Subsequently he became successively treasurer and secretary of the company; in 1873 secretary and treasurer of the Lake Shore and Michigan Southern; in 1883 its vice-president; and in 1878 secretary of the Michigan Central, in 1883 its vice-president. From 1883 he was also secretary, or treasurer, or both, in 15 other companies.

WORCESTER, Elwood, American Protestant Episcopal clergyman and author: b. Massillon, Ohio, 16 May 1863. He was graduated at Columbia University in 1886 and received the degree of Ph.D. at the University of Leipzig in 1889. He was professor of philosophy and psychology at Lehigh University in 1890–96, also serving as chaplain; was acting rector at Saint John's, Dresden, Germany, in 1894–95; rector of Saint Stephen's, Philadelphia, in 1896–1904, and has since had charge of Emmanuel Church, Boston. He originated the Emmanuel Movement, which gives moral treatment for nervous and, rarely, for organic disorders, with the aid of medical practitioners in such cases as require medical assistance. His works include 'Religious Opinions of John Locke' (1889); 'The Book of Genesis in the Light of Modern Knowledge' (1901); 'Religion and Medicine' (1907); 'The Living Word' (1908); 'The Christian Religion as a Healing Power' (1909); 'Religion and Life' (1914); 'The Issues of Life' (1915), etc.

WORCESTER, Joseph Emerson, American lexicographer and philologist; b. Bedford, N. H., 24 Aug. 1784; d. Cambridge, Mass., 27 Oct. 1865. He was graduated from Yale in 1811, and from 1819 resided in Cambridge, Mass., busily preparing and publishing books. Among his earlier works, compiled with much accuracy and excellent considerations, were 'A Geographical Dictionary' (1817), of which an enlarged edition appeared in 1823; a 'Gazetteer of the United States' (1818); and 'Outlines of Scripture Geography' (1828). His first effort in English lexicography was an edition of 'Johnson's English Dictionary, as Improved by Todd and Abridged by Chalmers, with Walker's Pronouncing Dictionary Combined' (1828). In 1829 he prepared an abridgment of Webster's 'American Dictionary'; and in 1830 published his 'Comprehensive Pronouncing and Explanatory Dictionary.' After collecting philological works in Europe in 1830–31, he edited the 'American Almanac' in 1831–43, and in 1846 published the 'Universal and Critical Dictionary of the English Language.' His chief work, 'A Dictionary of the English Language,' appeared in 1860, being the first work of the sort to employ illustrations. For this many collaborators were employed, particularly for the definition of technical terms.

WORCESTER, Noah, American theologian: b. Hollis, N. H., 25 Nov. 1758; d. Brighton, Mass., 31 Oct. 1837. He was a fifer in the Continental army in 1775, and entered the service again for a short time as fife-major in 1777. In 1786 he was licensed to preach by a Congregational association, and in 1787 ordained pastor of the church in Thornton, N. H., where he had held local offices and been elected representative to the General Court. In 1802 he was employed as the first missionary of the New Hampshire Missionary Society, and in that capacity traveled and preached widely in the northern portion of the State. In 1810 he removed to Salisbury and took charge of the

congregation, and in 1813 settled at Brighton, Mass. His work on the doctrine of the Trinity, entitled 'Bible News of the Father, Son, and Holy Ghost' (1810), soon became the subject of severe criticism, the Hopkinton association, of which he was a member, passing a formal sentence of condemnation against the book. From 1813 to 1818 he edited *The Christian Disciple*, a periodical published in Boston, and in 1814 published his tract, 'A Solemn Review of the Custom of War,' once well known, and translated into several languages. Shortly after this the Massachusetts peace society was formed, and in 1819 he began *The Friend of Peace*, which continued in quarterly numbers for 10 years, nearly the whole of it being written by himself. In 1829 he published 'The Atoning Sacrifice, a Display of Love, not of Wrath'; in 1831, 'The Causes and Evils of Contention among Christians'; and in 1833, 'Last Thoughts on Important Subjects.' Among his further writings is a 'Respectful Address to the Trinitarian Clergy' (1812). Consult Ware, Henry, 'Memoirs of Noah Webster, D.D.' (Boston 1844).

WORCESTER, Samuel Austin, American missionary and translator: b. Worcester, Mass., 19 Jan. 1798; d. Park Hill, Indian Territory, 20 April 1868. His father was a Congregational minister and also a printer. His parents moved to Vermont during his childhood. He was educated in the University of Vermont (of which his uncle, Rev. Samuel Austin, was president), where he was graduated in 1819. He was graduated from Andover Theological Seminary in 1823 and in 1825 was ordained to the ministry and shortly afterward entered the service of the American Board of Commissioners for Foreign Missions, being assigned to duty at Brainerd Mission in East Tennessee. In 1827 he was transferred to New Echota, Ga., which was the Cherokee capital. He aided in the establishment of the *Cherokee Phœnix*, which was the first paper to be printed in the Cherokee language and alphabet. In March 1829 he was arrested by the Georgia authorities because of his refusal to take a special oath of allegiance to that State — an obligation which had been devised and prescribed for the avowed purpose of discouraging missionary work among the Indians. He was released but was re-arrested, tried, convicted and sentenced to the State penitentiary for the term of four years. Clad in the garb of a felon, he was confined at hard labor until January 1833, though the Supreme Court of the United States had decided nearly a year before that his imprisonment was illegal. He then returned to Brainerd where he was beyond the jurisdiction of Georgia. In 1835 he moved to the Indian Territory, whither the Western Cherokees had removed from Arkansas in 1829. After visiting the Dwight Mission he tarried for a season at Union Mission, where he set up the first printing establishment in the Indian Territory. In December 1836 he settled at Park Hill, five miles south of the present town of Tahlequah, where his mission was established and where he labored during the remainder of his life. In addition to his work as a preacher and teacher Mr. Worcester devoted himself to the task of translating various works into the Cherokee language, to be printed and published at his Park Hill Mission. The mission press also printed many books and pamphlets for the missionaries laboring among the Creek, Seminole, Choctaw and Chickasaw nations. His own translations included large portions of the Bible, tracts, hymn-books, school books and the Cherokee Almanac, printed in English and Cherokee, with astronomical calculations for the meridian of Fort Gibson. In translating the Bible he rendered the text from the original Hebrew directly into Cherokee without the medium of either the Greek, Latin or English versions. Prior to his removal to the West he had laboriously prepared manuscripts for a grammar and a dictionary of the Cherokee language, both of which were unfortunately lost when the steamboat transporting his personal effects was sunk while ascending the Arkansas River. He was greatly revered among the Cherokees by whom he was known as "The Messenger." Consult Mooney, James, 'Myths of the Cherokee' (in 19th Annual Report of the Bureau of American Ethnology); Lumpkin, Wilson, 'Removal of the Cherokee Indians from Georgia'; Benson, Henry C., 'Life Among the Choctaws'; and Drake, Samuel G., 'The Aboriginal Races of North America.'

WORCESTER, England, (1) a city, the capital of Worcestershire, situated in a beautiful vale on the eastern bank of the Severn, 120 miles west-northwest of London. The cathedral is a noble specimen of Gothic simplicity. It was first erected by Ethelred, king of Mercia, in 680, and a later edifice was burned down and rebuilt in the beginning of the 13th century. It was restored in 1857–74. It is 394 feet long, 78 feet wide and 68 feet high, and the tower, which rises from the intersection of the nave and aisles to the altitude of 170 feet, is ornamented at the corners by lofty pinnacles. It contains many handsome monuments and sculptures, including the tombs of King John, of Bishop Gauden and of Arthur, Prince of Wales and son of Henry VII. There are about 20 other handsome places of worship, such as Holy Trinity, Saint Nicholas, Saint Andrew's, Saint Helen's etc. Among other buildings are the shire-hall, guildhall, Victoria Institute (library, museum, etc.), corn-exchange, the hop and fruit market, museum of natural history, two grammar-schools, several charitable institutions, etc. Worcester is the chief seat of the English leather glove trade, has celebrated porcelain-works, "Worcester sauce" works, vinegar-works, chemical and manure works, foundries, railway signal works, locomotive works, horse-hair weaving, agricultural implements, carriage factories and other works. Its trade in hops is extensive. There are municipal electric lighting works and a service of electric trams. The most remarkable event here was the victory of the English army, under Cromwell, over the Scotch in the cause of Charles II, in 1651. There are traces of Roman occupation, but its history dates from the establishment of the Episcopal see in the 7th century. The first charter was obtained from Philip and Mary in 1554; James I granted another in 1622 and its government was again altered by the Municipal Reform Act of 1835. Pop. about 50,000. (2) An inland county bounded on the north by Shrop and Stafford, on the west by Hereford, on the south by Gloucester and on the east by

Warwick; with some separated portions, enclosed by the counties of Gloucester and Warwick. The area is 751 square miles. The surface, generally level or gently undulating, has some extensive and beautiful vales, the principal of which, that of the Severn, is 30 miles long and one quarter to a mile broad. On the southwest are the fine Malvern Hills, the loftiest of which is 1,444 feet above set-level. The soil, composed chiefly of clay and loam, is of great fertility. The principal crops are wheat, barley, oats, beans, peas, turnips and hops. The orchards are celebrated for their apples and cider. The vales consist of meadows and rich pastures. The sheep are of the Leicester breed. Coal is found in the north and northwest; the brine springs at Droitwich and Stoke Prior supply immense quantities of salt; iron is found with the coal, and the manufacture of iron and steel, and of hardware, is extensive; carpets and rugs are made at Kidderminster; and porcelain, gloves and other articles at Worcester. Pop. 427,064. Consult Brassington, 'Historic Worcestershire' (Birmingham 1894–95).

WORCESTER, Mass., city and county-seat of Worcester County, on the Blackstone River, and on the New York, New Haven and Hartford, the Boston and Maine and the New York Central railroads, 44 miles west of Boston and 45 miles northwest of Providence. Electric railways extend to all the nearby towns and to Boston. The city was begun in a valley, but it now occupies a number of the surrounding hills; the elevation above sea-level is 481 feet; area, 38.41 square miles.

Industries.— Worcester is noted for the number and variety of its manufacturing establishments. According to the State census the city's manufactured products in 1915 were valued at nearly $100,000,000, while the figure for 1917 reached nearly $193,000,000. Among the numerous factories are those producing steel, wire, machine-tools, grinding wheels, carpets, leather goods, steam and electric cars, firearms, textile machinery, automobile parts, musical instruments, chains, etc. About 6,500 men are employed in the building trade. There are approximately 3,200 mercantile establishments employing about 25,000 people. The trading population of the suburbs is estimated at about 450,000. Owing to its large, up-to-date machinery equipment, Worcester became one of the most important war material producing cities in the country.

Buildings and Municipal Improvements.— The principal public buildings are the Federal building, courthouse, city hall ($650,000), State armory, Mechanics Hall, the Young Men's Christian Association, the Young Women's Christian Association, buildings of the women's clubs and of several fraternal organizations, the State Mutual Assurance Company, Masonic temple, one of the finest in New England, several charitable institutions, the religious and educational institutions and the union station. There are 17 public parks, having a combined area of 1,091.88 acres; Lake Park has 110 acres and Elm Park 80 acres. Playgrounds occupy 74 acres. The system of waterworks cost $7,150,000. The sewer system covers about 240 miles and cost $5,977,490. Together with the sewerage pumping and purification works the total cost is over $7,000,000. The city is divided into 10 wards, which diverge from its centre like the spokes of a wheel. The principal business streets run north and south. There are 221 miles of public streets, 12 theatres and 33 hotels.

Churches, Charitable and Educational Institutions.— There are over 100 church organizations with property valued at $3,000,000. The denominations rank, according to the number of their buildings, as follows: Congregationalist, Baptist, Methodist Episcopal, Roman Catholic, Protestant Episcopal, Unitarian and others one or two each. The hospitals are the Washburn Memorial Hospital, for women and children, the City Hospital, Homœopathic Hospital, and Saint Vincent's Hospital. Other Institutions are the State Insane Asylum, the State Odd Fellows' Home, Saint Ann's Orphan Asylum, Saint Vincent's Home for the Aged, Saint Francis' Home for the Aged, Our Lady of Mercy Orphanage, a home for the friendless, and a number of private hospitals. The educational institutions are Clark University, a post-graduate school for original research, opened in 1889, Clark College, Worcester Polytechnic Institute, College of the Holy Cross (Roman Catholic), opened in 1843, the Bancroft School, Kimball's School for Girls, Saint John's School (Roman Catholic), Worcester Academy, Assumptionist College, Becker's Business College, Hinman's Business College, State Normal School, Boy's Trade School and Girls' Trade School, the evening high school, 74 public school buildings (four public high schools) and 10 portable schoolhouses, the Free Public Library, two antiquarian societies, historical and literary societies and several school libraries. There are altogether more than 30 libraries with some 600,000 volumes; the Public Library contains 219,000 volumes. There are also 594 newspaper and magazines. Worcester boasts one of the finest art museums in the United States, with an endowment of $4,000,000.

Banks and Finances.— In 1919 Worcester had five savings banks with deposits of $100,000,000; two national banks; two trust companies and four co-operative banks. At 1 July 1917 the city had a valuation of more than $187,000,000 with $7,000,000 exempt. This valuation does not include $15,000,000 intangible personalty taxed directly by the commonwealth. The four insurance companies (one life and three fire) have total assets over $56,500,000, with a total surplus of about $5,000,000. The municipal expenditures for maintenance and operation are about $6,500,000. The chief items of expense are as follows: schools, $1,200,000; streets, $600,000; fire department, $320,000; police department, $495,000; charity department, $350,000; public library, $82,000.

Government.— The government is vested in a mayor, whose term of office is one year. He is the chief executive officer and has extensive power of veto over the acts of the board of aldermen and the common council, the former consisting of 11 members, one from each ward and one at large; and the latter of 30 members, three from each ward. The two boards constitute the city council, who have power to accept or reject the mayor's appointments. The council elects the heads of the departments.

History.— A settlement was made here in 1673–74, called Quansigamog Plantations. The

Indians were hostile to the settlers from the first; but at the beginning of King Philip's War, their hostility increased and the whites abandoned the settlement. Another attempt to found a settlement was made in 1684, but after a few years the Indians forced the whites again to leave. The second time the place was named Worcester on account of Worcester in England having been the home of some of the settlers. In 1713 the permanent settlement was made. In 1722 Worcester was incorporated; and chartered as a city in 1848. Isaac Thomas, a publisher, moved from Boston to Worcester in 1775, and until about 1800 the town was among the leading publishing places in the country.

Population.—The city ranks second in the State in population which is made up of 50 nationalities. Since 1850 it has grown rapidly. Beginning with 1800 the Federal census returns have given the following: (1800) 2,411; (1820) 2,962; (1850) 17,049; (1870) 41,405; 1880) 58,291; (1890) 84,655; (1900) 118,421; (1910) 145,986; (1915 State census), 162,697; (1919 official estimate), 200,000.

Consult Blake, F. E., 'Incidents of the First and Second Settlements of Worcester' (Worcester 1884); Hurd, D. H., 'History of Worcester County' (ib. 1889); Lincoln and Hersey, 'History of Worcester' (1837–62); Metcalfe, L. N., 'Illustrated Business Guide to the City of Worcester' (ib. 1880); O'Flynn, 'School History of Worcester' (1910); Nutt, 'History of Worcester and Its People' (1919); Rice, 'Worcester in 1898' (ib. 1899).

JOHN D. HUGHES,
Secretary of Mercantile Bureau, Worcester Chamber of Commerce.

WORCESTER, South Africa, a town of Cape Colony, 60 miles northeast of Cape Town, 109 miles by rail through Paarl and Tulbagh. The town is regularly laid out, the streets being planted with trees. It is well supplied with water from the Hex River. The vine is extensively cultivated in the neighborhood and brandy and wine are made in considerable quantity. Pop. about 6,000.

WORCESTER COLLEGE, Oxford, England, originally called Gloucester Hall, was founded in 1714 by Sir Thomas Cookes of Bentley, Worcestershire, for a provost, six fellows and six scholars. Under the statutes of 1882 Worcester College consists of a provost, 9 or 10 fellows, and 19 scholars. There are a number of exhibitions, two of which are connected with the Charterhouse School, and three with Bromsgrove School. There are 10 livings within the gift of the college. See OXFORD UNIVERSITY and consult Daniel and Barker, 'Worcester College' (London 1900).

WORCESTER MUSICAL FESTIVAL, an annual musical event held at Worcester, Mass., consisting of four concerts, including one or more large oratorio or choral work, given under the auspices of the Worcester County Musical Association. The festival is the outgrowth of the joint meetings of the choirs in the vicinity, and the first festival was given in September 1858. The choirs were regularly organized at the Worcester County Musical Convention in 1863, and the present name was adopted in 1871. The first entire oratorio was given in 1866, with Karl Zerrahn as conductor. Zerrahn continued as conductor until 1897; G. W. Chadwick was conductor in 1898–1901; Walter Doodrich occupied the office in 1902–07, and since the 1908 festival Arthur Mees has been conductor. Victor Herbert was associate conductor in 1889–91, and Franz Kneisel in 1892–1908. The musical festival held at Worcester, England, is known as the Three Choirs Festival.

WORCESTER POLYTECHNIC INSTITUTE, a professional school of engineering and chemistry located at Worcester, Mass. It was founded by a gift of $100,000 from John Boynton of Templeton; was chartered in 1865, and opened to students in 1868. Since that time its resources have been largely increased both by private benefactions and State donations. Though one of the earliest schools of the kind in the United States, it has in every way kept pace with the progress in scientific and technical education, and is recognized as one of the leading American technical schools. From the time of its organization, laboratory and shop work have been a distinctive feature of its plan; it was one of the first schools to emphasize the importance of laboratory methods and the first in the United States to establish a workshop as an essential part of the training in mechanical engineering. The institute offers five courses of four years each leading to the degree of B.S.; these are mechanical, civil and electrical engineering, chemistry and general science. English, political science, French or German, and mathematics are included in all courses; the work of the freshman year is practically the same for each course; with the sophomore year the special work of each course begins. The work of the junior and senior years of the general science course is largely elective; otherwise the courses are practically all prescribed. Graduate courses are provided leading to the degrees of M.S., D.S., M.E., C.E., E.E., and Ch.E. The students maintain a Christian association, student branches of the national engineering societies, chapters of several Greek fraternities and an athletic association. The institute publishes a bi-monthly *Journal*, containing original articles on technical and scientific subjects by the alumni and faculty and news of the institute and general scientific progress. The students publish a weekly paper. The institute campus comprises 34 acres on a slight elevation in the northwestern part of the city; it slopes on the north to Institute Park and includes a large athletic field with a quarter mile track, gridiron and baseball diamond. The buildings on this campus are Boynton Hall, the Washburn shops (pattern, machine and forge), the Salisbury laboratories (chemistry, physics), the electrical engineering laboratories, the mechanical laboratories, the power laboratory, the foundry, the magnetic laboratory, and the alumni gymnasium and the Alden hydraulics laboratory at Chaffinsville, five miles distant. The laboratories and shops are all excellently equipped; the library in 1919 contained 17,096 volumes including departmental libraries; the Worcester Free Public Library, with 230,000 volumes in 1919, is also open to students. Free tuition is given to 40 Massachusetts students in consideration of which the institute receives an annual State appropriation. The students in 1919 numbered 474, and have averaged over 500 for the past 10 years; the total number of graduates was 2,075.

which were written just before the book appeared. Five hundred copies were issued, but most of them were afterward sold to a London bookseller at a sacrifice. When Cottle gave up business soon afterward, his copyrights were transferred to Mr. Longman of London, and in the estimation of their value the 'Lyrical Ballads' were put down as "worth nothing." Cottle, therefore, asked that the copyright might be given back to him, and, the request being granted, he made a present of it to the authors, who both lived to see it become a piece of really valuable literary property. It is not easy to imagine a book containing 'The Ancient Mariner' and the 'Tintern Abbey' reckoned absolutely worthless, from a commercial point of view, only about a century ago.

Immediately after the publication of the 'Lyrical Ballads,' Wordsworth, his sister and Coleridge sailed for Hamburg, with a view of perfecting their acquaintance with the German language by a winter at Goslar. During the four months spent in that dull and dismal town, in a particularly cold and disagreeable season, Wordsworth wrote some of his best and most characteristic poems, full of the loveliness of English rural scenery and life. Coleridge traveled independently of his friends a part of the time they were abroad, but the three made excursions together in the rural districts of Germany, and had some unpleasant experiences. Sometimes they found it difficult to obtain food and shelter in the wretched inns of the country. In one instance, as Coleridge records, they were actually driven out of doors and had to spend the night in the fields. But they met with no worse misadventures than these, and the Wordsworths got safely back to England in the spring of 1799.

The poet was always fond of travel, and in later years frequently indulged in it both in the British Isles and on the Continent. In August 1802, he went to France again, and in 1803 and 1814 visited Scotland. In 1820 he went with his wife and sister through Switzerland and Italy. In 1823 he traveled in Holland, in 1824 in North Wales, in 1828 in Belgium with Coleridge, and in 1829 in Ireland with his friend Marshall. In 1831 he and his daughter visited Scott at Abbotsford. In 1833 he made another tour in Scotland, and in 1837 a long one in Italy with Crabbe Robinson. In all these journeys he found more or less material and inspiration for his poems.

After his return to England in 1799 he and his sister decided to settle down in their ancestral Lake Country, and soon took a small cottage at Grasmere. Here and in the immediate vicinity the remainder of their lives, except for the occasional journeys abroad, was passed in domestic and poetic seclusion, with few important incidents to disturb the calm current of the lapsing years. In 1802 the poet married Mary Hutchinson, whom he had known from childhood and with whom he had attended the same "dame's school" at Penrith, where his boyhood was partly spent with his mother's parents. After his marriage he and his wife continued to reside with his sister at Grasmere, and there three of his children were born. From 1808 to 1813 the family lived in the same neighborhood in two other houses, and then removed to Rydal Mount, a few miles distant, which was the poet's home for 37 happy years. There, among his native lakes and hills, he died in his 81st year.

In his early manhood the poet's resources were very slender, but his tastes were simple and he made what he had suffice for his needs. He and his sister managed to live for six or seven years on about $500 a year. Later he came into possession of a little property, and later still was appointed stamp-distributor for Cumberland and Westmoreland, an office worth £500 a year, the duties of which were mostly discharged by a clerk, leaving the poet leisure for his literary pursuits. In 1803 he became acquainted with Sir George Beaumont, a descendant of the dramatist and a cultivated man, who presented him with a beautiful piece of land at Applethwaite, near Skiddaw, hoping that he might be induced to settle there, but he could not make up his mind to leave his chosen home at Grasmere. His friendship with Beaumont remained unbroken until the death of the latter in 1827.

Wordsworth retained the stamp-collectorship until 1842, when it was transferred to his second son. A more lucrative office, the collectorship of Whitehaven, was offered him, but he declined it, being unwilling to exchange his secluded life at Rydal "for riches and a load of care." In 1843, he was made poet-laureate on the death of Southey. He declined the honor at first as imposing duties which at his advanced age he hesitated to undertake; but he finally accepted it, at the personal solicitation of Sir Robert Peel, who assured him that nothing "should be *required* of him," adding that the appointment was "a tribute of respect justly due to the first of living poets," that "the queen entirely approved of the nomination," and that there was "one unanimous feeling on the part of all who had heard of the proposal that there could not be a question about the selection."

In 1800 a second edition of 'Lyrical Ballads,' with other poems, was published, and others appeared in 1802 and 1805. Meanwhile, the poet had made few friends and many and bitter enemies. The issue of two more volumes of 'Poems' in 1807 led to a fresh onslaught upon the author, who persisted in writing verse after the autocratic *Edinburgh Review* had given judgment against him. Jeffrey, in noticing the new volumes in the *Review*, remarked: "Even in the worst of these productions there are, no doubt, occasional little touches of delicate feeling and original fancy; but these are quite lost and obscured in the mass of childishness and simplicity with which they are incorporated." Such was the high critical verdict upon a collection of poems that included the 'Ode to Duty,' the 'Sonnets dedicated to Liberty,' 'The Happy Warrior,' the exquisite lines, "She was a Phantom of Delight," etc., and the sublime 'Ode on the Intimations of Immortality.' Eight years elapsed before another edition of the poems was printed; and the year previous (1814) Wordsworth had published 'The Excursion.' Five hundred copies of this sufficed to supply the demand for six years. The new poem was savagely treated by Jeffrey, who boasted that he had "crushed 'The Excursion'." Southey remarked: "He might as well seat himself on Skiddaw, and fancy that he crushed the mountain." Jeffrey

began his crushing criticism with "This will never do," and went on to pronounce the poem "longer, weaker and tamer than any of Mr. Wordsworth's other productions"; but though he and his fellow reviewers prevented the sale of the poem, they could not kill it, in spite of its obvious faults.

Other volumes were brought out by the undismayed poet in 1815 ('The White Doe of Rylstone'), in 1819, 1820 and 1822, and all were condemned by the *Edinburgh Review*, as they appeared; but the reaction had now begun among the critical authorities, and henceforth Wordsworth had powerful defenders in literary circles. "War was no longer waged *against* his poems, but rather *concerning* them." It was, however, a long fight yet before their rightful position was accorded them by the general consent of the contending parties. De Quincey has well summed up the matter thus: "From 1800 to 1820 the poetry of Wordsworth was trodden under foot; from 1820 to 1830 it was militant; from 1830 and onward it has been triumphant." And the triumph was complete. There were still those who could see little to admire in the meditative measures of the Cumberland recluse, but the general verdict was in his favor, and his place among the great poets of our literature was secure beyond dispute. Honors, too, were conferred upon him. In 1839 he received the degree of D.C.L. from Oxford University; and the enthusiasm of the audience on the occasion was such as had never been known except upon the visits of the Duke of Wellington. One who was present says: "Scarcely had his name been pronounced than from 3,000 voices at once there broke forth a burst of applause, echoed and taken up again when it seemed about to die away, and that thrice repeated." The poet no doubt went through the ceremony with his wonted calmness and composure; but it was none the less significant as a tribute to the man and a testimonial that he had fairly won the laurel crown. A few years later, as we have seen, he received the further honors of a government pension and the laureateship.

Wordsworth's famous theory of poetic art was first set forth in the preface to the second edition of the 'Lyrical Ballads' (1800), and more at length subsequently in prefaces and appendixes. He took the ground that not only might the poet draw his subjects from common life, but he might treat of them in the language of common life. "I have proposed to myself," he says, "to imitate and, as far as is possible, to adopt the very language of men. . . . I have taken as much pains to avoid what is usually called poetic diction as others ordinarily take to produce it." And again he asserts that "there neither is, nor can be, any essential difference between the language of prose and metrical composition." But his theory was the result of his rebellion against the highly artificial style of Pope and his school, and like many reformers, he was at first inclined to go too far in the opposite direction. He himself admitted this later by giving up the puerile style in which many of his earlier poems were written and adopting a more elevated diction, and also by changing some of the most prosaic expressions in those early poems. To take one single example of these emendations, in 'The Thorn,' one of the 'Lyrical Ballads,' as printed in 1798 and 1815, we have this arithmetical statement:

> And to the left, three yards beyond,
> You see a little muddy pond
> Of water never dry.
> I've measured it from side to side.
> 'Tis three feet long and two feet wide.

Crabbe Robinson told Wordsworth that "he dared not read these lines aloud in company." "They ought to be liked," was the poet's reply; but he nevertheless modified the last two lines in 1820, so that now they read:

> Though but of compass small and bare
> To thirsty suns and parching air.

Wordsworth was much gratified at the comparatively early appreciation of his works in America. The 'Lyrical Ballads' were reprinted at Philadelphia in 1802, and an edition of his poems in four volumes appeared in Boston in 1824. A complete edition was brought out (Philadelphia 1837) by Prof. Henry Reed, with whom the poet interchanged many letters. In one of these he says: "The acknowledgments which I receive from the vast continent of America are among the most grateful that reach me." Reed's edition was revised and enlarged in 1851. In 1854, a Boston edition in seven volumes was published, with a biographical introduction (though without his name) by James Russell Lowell. Thirty years later (1884) when Lowell was Minister to England, he was made president of the Wordsworth Society, and in the closing words of an address on that occasion he thus aptly and admirably expressed what we may call the "true mission" of the poet:

"As in Catholic countries men go for a time into retreat from the importunate dissonances of life to collect their better selves again by communion with things that are heavenly and therefore eternal, so this Chartreuse of Wordsworth, dedicated to the Genius of Solitude, will allure to its imperturbable calm the finer natures and the more highly tempered intellects of every generation, so long as man has any intuition of what is most sacred in his own emotions and sympathies, or of whatever in outward nature is the most capable of awakening them and making them operative, whether to console or strengthen. And over the entrance gate to that purifying seclusion shall be inscribed:

> Minds innocent and quiet take
> This for a hermitage

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side the working class, and include in their membership both workingwomen and "women of leisure"; one of their great benefits is the promotion of understanding and sympathy between these two classes. The clubs are entirely self-governing, all members being on an equal tooting and having equal share in the management. They are also self-supporting by means of moderate fees and the proceeds of entertainments. The club rooms furnish the workingwomen with a place for recreation with pleasant surroundings and the social feature is emphasized, but the educational side is not neglected; public questions are discussed and instruction in domestic science, stenography, etc., is given. In some cases the clubs have been instrumental in obtaining reforms in industrial conditions for women; the Massachusetts State League, for instance, was largely influential in establishing the eight-hour day in Boston department stores. Some clubs maintain vacation homes.

WORKMAN, Fanny Bullock, American traveler and mountain climber, wife of W. H. Workman: b. Worcester, Mass., about 1850. She was a daughter of Gov. A. H. Bullock of Massachusetts, and was educated in New York and in France and Germany. She was married in 1881, afterward traveling with her husband in Northern Africa, Asia Minor and the Far East. In 1889 she made several record first ascents for women in the Himalayas, of which the highest was Mount Koser Gunge, 21,000 feet in altitude. She gained the women's world record for mountaineering in 1906 by her ascent of the Nun Kun Peaks, reaching an altitude of 23,300 feet. In 1912 she surveyed the Rose Glacier, and discovered the watershed between the Indus and the Turkestan regions. She is a Fellow of the Royal Geographical Society, and has collaborated with her husband in writing books of travel.

WORKMAN, George Coulson, Canadian educator and theological writer: b. Grafton, Ontario, 28 Sept. 1848. He was graduated at Victoria University in 1875, and received the degree of Ph.D. at the University of Leipzig in 1889. In 1876–78 he was assistant editor of the *Christian Guardian,* and he afterward served several years as a pastor in the Methodist Church. He was professor at Victoria University, Coburg, in 1884–91; and in 1904–08 he was professor of Old Testament exegesis and literature at the Wesleyan Theological Seminary, Montreal. He was later engaged in writing and gained a high reputation as a biblical critic. He has written 'The Text of Jeremiah' (1889); 'The Old Testament Vindicated' (1897); 'How to Study the Bible' (1902); 'The Servant of Jeremiah' (1907); 'At Onement, or Reconciliation with God' (1911), etc.

WORKMEN'S COMPENSATION, a system of indemnifying wage-workers and employees generally for economic losses caused by injuries (either through accident or occupational disease) and due to employment. The modern development of industry, especially through application of mechanical energy and complicated machinery and through the growth in the dimensions of industrial operations, has raised industrial accidents and injuries to the dignity of a grave social problem. It is enough to point out that in Germany alone the number of accidents reported annually exceed 700,000, of which the fatalities approach 10,000; that in the United States the number of industrial accidents is estimated from 2,000,000 to 3,000,000 and the fatalities from 25,000 to 30,000 a year.

The theory of compensation first developed in Europe when the older theory of employers' liability (q.v.) proved inadequate to meet the economic problems created by these fatal or disabling accidents. Employers' liability, or the general legal principle of liability based upon the code civil, gave the injured workman the right to recover damages if he could establish by proper evidence that the accident was due to the negligence of the employer or his agent. In the nature of things this was possible only in a small percentage of cases, perhaps 10 per cent; in a large number of cases the accidents were found to be due to the negligence of the injured employee, or of one of his fellow employees, or the inherent hazards of the industry. The result was a rapid increase in litigation with comparatively little benefit to the injured. This became a serious problem in the more hazardous industries and special legislation developed in the railroad and mining fields. Beginning with the early 70's the problem of industrial accidents began to attract the attention of European legislators. The earlier proposals were directed at a change of the burden of proof, so as to force the employer to show that the accident had occurred without any negligence on his part, rather than to require the injured person to establish negligence. The next step was the announcement of the doctrine of "trade risk" (risque professionelle, in French terminology) This established a right of recovery when an accident was admittedly due to no one's negligence but to the inevitable hazard of the industry. Yet even with these modifications the doctrine of employers' liability failed to give general satisfaction. The final step in the evolution of the compensation method was taken in Germany when the question of negligence was entirely left out. Proposals made in 1879 have materialized in Germany in legislation in 1884. This legislation established on right of recovery entirely irrespective of the question of causation of the injury, but simply on the basis of the fact. On the other hand, it announced the principle of a specified (admittedly partial) compensation according to a definite schedule, in which compensation is graded according to the nature of the injury, the degree and duration of disability and generally the wage-earning capacity of the injured person.

The movement for accident compensation once begun in Germany, spread rapidly throughout Europe and later through other parts of the world — as the following list indicates (in which the acts are listed according to the year in which they have passed). *Europe* —Germany, 1884; Austria, 1887; Norway, 1894; Finland, 1895; Great Britain, 1897; Denmark, Italy, France, 1898; Spain, 1900; Greece, Netherlands, Sweden, 1901; Luxemburg, 1902; Russia, Belgium, 1903; Hungary, 1907; Bulgaria, 1909; Lichtenstein, Servia, 1910; Switzerland, 1911; Roumania, 1912; Portugal, 1913. *British Colonies* —New Zealand, New South Wales, S. Australia, 1900; British Columbia, 1902; New Brunswick, 1903; Cape of Good Hope, Queensland, 1905; Transvaal, 1907; Alberta, Newfoundland, 1908; Quebec, 1909; Manitoba, Nova

Scotia, 1910; Tasmania, Saskatchewan, Labrador, 1911; W. Australia, 1912; Victoria, 1914; Ontario, 1916. *Other Foreign Countries.*— Leon (Mexico), Venezuela, 1906; Peru, Japan, 1911; Cuba, 1916. *United States.*— Maryland, 1902; United States (government employees), 1908; Montana, 1909; New York, 1910; Kansas, Washington, New Jersey, California, New Hampshire, Wisconsin, Illinois, Ohio, Massachusetts, 1911; Michigan, Rhode Island, Arizona, Canal Zone, 1912; West Virginia, Oregon, Nevada, Texas, Iowa, Nebraska, Minnesota, Connecticut, New York, 1913; Maryland, Louisiana, Kentucky, 1914; Wyoming, Indiana, Montana, Oklahoma, Maine, Vermont, Colorado, Hawaii, Pennsylvania, 1915; Kentucky, Porto Rico, 1916; New Mexico, Idaho, 1917; Delaware, 1918.

This long list of legislation seems to indicate that the basic principle is accepted now throughout the civilized world. It represents a victory of the economic and social considerations of need over the purely legal considerations of personal fault and responsibility.

Though based upon the same general principle, the numerous compensation acts present a very great variety of provisions. The special features of the American compensation legislation will be referred to presently, and in view of the very large number of compensation acts, only the most important European acts need to be compared here.

Though the elimination of the principle of fault lies at the very bottom of all compensation legislation, in several acts vestiges of the concept still remain, as for instance in the exception of accidents due to wilful misconduct (Great Britain) or even gross negligence (Denmark, Russia, Sweden, etc.). In some acts (Great Britain) compensation is limited to accidents arising "out of employment," but the prevailing tendency is to cover all accidental injuries sustained *during* employment (Germany, Austria, Hungary, France, Italy), so as to avoid all unnecessary enquiry and controversy.

In comparatively few countries have all employees been covered. During the early history, when compensation was still considered an experiment, it was limited to specified groups of industries and wageworkers; and while in most countries by subsequent amendments the application of acts was rapidly extended, Germany and Great Britain are perhaps the only ones in which the acts are almost universal. Agricultural laborers are still outside of the compensation acts in most countries, and office and clerical employees and even all commercial establishments are excluded in most European acts.

Within the recent years, with better study of occupational hygiene, the danger of vocational diseases (such as poisons, etc.) has attracted a great deal of attention. The British and the Swiss acts are, however, the only ones which include such occupational diseases under compensation. In the other acts the fact of sudden occurrence of the injury through an accident must be established, and the entire branch of legislation is still known as accident compensation

Next to the elimination of the question of fault, the specific benefit scale is a fundamental feature of the compensation system, a benefit scale which admittedly grants a limited and not full compensation for losses sustained. One method of limitation is the waiting period which leaves minor accidents entirely without money compensation. This waiting period varies between two days (in the Netherlands), or three days (in Austria-Hungary), or none in Italy and Spain, to 13 weeks in Denmark or Germany. In four countries, however, all accidents are treated and compensated out of the compulsory sickness insurance system (13 weeks in Germany and Russia, 10 weeks in Hungary and four weeks in Austria). The general method of compensation is a weekly benefit in proportion to the usual earnings of the injured person, the proportion varying between 50 per cent and 66⅔ per cent, though scales up to 80 per cent are occasionally met. This method of weekly compensation during the time of disability is considered preferable to a lump sum usually payable as a result of litigation under liability laws, because it is better adapted to the normal conditions of a wageworker's existence and prevents the squandering of the indemnity either in unwise living or unwise investment.

The compensation of partial disability, which often is permanent in character, raises many complicated problems. The economic consequences of such injuries are a decrease in earnings rather than total disability. The German method followed by many acts is to grant a permanent pension commensurate with the degree of loss of earning capacity. This is admitted, however, to develop undesirable consequences; a very large number of persons drawing very slight pensions, a desire to retain this small pension by constant exaggeration of insignificant injuries, and a commutation of small pensions to lump sums finds many advocates.

Still more complicated is the compensation for fatal accidents. Here many different methods are found, from lump sums to life pensions. The latter method is recognized as preferable, and the pension in proportion to the wages is adjusted to the number of surviving dependents. The latter includes the widow and orphans under a certain specified age (from 14 to 18 in various acts) and sometimes other relatives, parents, brothers, grandchildren. The socially adequate way is to compensate the widow till death or remarriage; in the latter case a small lump sum is offered as a dowry so as to counteract the unfavorable influence of discontinuance of pension upon the frequency of remarriage. Some laws, however (and this includes the British Act and acts of most Britsh colonies) place definite money limits on the total amount of compensation for fatal accidents. It is evident, therefore, that the entire subject of compensation for industrial injuries is still in a primitive stage even in Europe. Up to the beginning of the European War there was a constant and growing stream of legislation by means of which compensation systems were being gradually extended and improved.

Workmen's Compensation in United States.—The movement for compensation legislation did not reach the United States until some 25 years after it began in Europe. Meanwhile the rapid industrialization of the country made the problem of industrial accidents a very grave one. The conditions of Employers'

Liability based upon the Anglo-Saxon common law are very much less favorable to the injured workman than the Code Civil of European countries. The doctrines of "fellow servant," "contributory negligence" and "assumption of risk" substantially affected the proportion of cases in which recovery was possible. For years legislative efforts were made to strengthen the liability of employers by complex legislation and the result was very much increased litigation with greater waste for attorney's fees, occasional heavy verdicts, and on the whole, very limited compensation to the injured.

Agitation for a radical change to a system of compensation appeared sporadically even toward the close of the last century, but gained strength only toward 1910, when a veritable flood of legislation appeared. The earlier acts were declared unconstitutional. In fact, the famous Ives decision by which the New York Compensation Act of 1910 was declared unconstitutional, influenced the subsequent development of legislation very strongly. A very large number of States adopted the so-called New Jersey or elective system. According to this system employers may elect or reject to come under a compensation system. But the penalty for rejection is a strengthening of the liability provisions by the abolition of some or all of the three doctrines above referred to, of "fellow servant, contributory negligence or assumption of cost," while the award for election is freedom from the obligations of employers' liability. In fact, most of the States are still operating their compensation under this elective system except Arizona, California, New York, Ohio, Washington, Wyoming, Maryland, Oklahoma. Of these seven States three (California, New York and Ohio) took the precaution to amend their State constitutions before passing compulsory acts, while in the other States the opinion prevailed that compulsory laws were not contrary to the Constitution of either the State or the Union. Opinions differ among authorities on Constitutional Law as to whether both compulsory or even elective (with their hidden methods of coercion) are in accordance with the Constitution of the United States.

The necessity of making compensation acceptable to employers under an elective system has kept the scale of benefits down so as to make it cheaper. The benefit scale of the numerous acts fluctuates considerably, the New York act of 1913 presenting the highest, and the acts of New Jersey, Colorado, Pennsylvania the lowest levels of compensation, so that on an average the New York acts offers about twice as much to the injured workman as the acts of New Jersey or Pennsylvania. Considerable dissatisfaction with the provisions of compensation acts is, therefore, rapidly accumulating. Most frequent causes mentioned is the length of the waiting period which remains two weeks in most acts, the 50 per cent scale of compensation, which is the rule, only five or six acts having raised it to 60 per cent or 66⅔ per cent and the strict time limitation for permanent injuries as well as fatal accidents, varying between 300 and 500 weeks. In some acts, however, the necessity for life pension in total or otherwise serious disabilities has been recognized (notably New York and California) as well as life pensions to widows.

An interesting feature of American Compensation acts is the so called dismemberment schedule, i.e., a schedule of specific benefits expressed in number of weeks of payments for loss of extremities or parts thereof. This was first introduced in New Jersey, being adopted from the usual commercial accident insurance contracts and was accepted by almost all of the other acts, because of its simplicity and ease of adjustment. It is questioned how just such an appraisal of surgical injuries irrespective of occupational difference can be.

The tentative character of these benefit provisions is shown by the very large number of amendatory acts notwithstanding the short history of compensation in this country. In Massachusetts the amendments of 1914 increased the average value of benefits by nearly 50 per cent. In other States elective acts were substituted by compulsory acts (California, Ohio, Maryland), in others the administrative provisions have been thoroughly rewritten. The strongest tendency in administration is the establishment of special commissions or board for adjudication of disputed claims and control of all settlements.

Compensation Insurance.— The compensation principle establishes new relations between employers and employees. In a certain sense it makes the employer an insurer of the employee. Unless, however, the principle of insurance would be further developed, compensation might prove a very serious hazard to the employer, especially the smaller employer. Most compensation laws contain, therefore, provision for insurance by means of which a collective responsibility takes the place of the individual responsibility of the employer. In some acts such insurance is compulsory and in the other only permissive. As to the organization of insurance an active struggle may be observed between ordinary commercial (stock) insurance companies, mutual insurance companies on general lines, employers' associations or State funds. The struggle expresses itself either in legislative elimination of some forms and provision for others, or in open competition between co-existing various forms.

A classification of the various compensation acts according to their insurance system may be presented in tabular form as follows: (1) Compulsory insurance in prescribed carriers (a) In a monopolistic State insurance fund (Norway, Switzerland, Ohio, Washington, Wyoming, Nevada, Oregon, West Virginia) (b) In employers' mutual association controlled by the State (Luxemburg, Roumania, Servia, Hungary, Austria, Russia, Germany, Greece). (2) Compulsory insurance with choice of insurance form. (a) State fund competing with private or mutual insurance companies (Italy, Netherlands, Maryland, New York, Oklahoma, Michigan, Colorado, Pennsylvania, Montana); (b) Private or mutual insurance companies (Massachusetts, Texas, Connecticut, Illinois, Iowa, Wisconsin, Indiana, Maine) (3) Voluntary insurance (a) State fund competing with private or mutual insurance carriers (Sweden, France, Portugal,

and dissemination of information, to familiarize himself with the more important events which have taken place throughout the world in the previous 24 hours, finds it very difficult to comprehend that during the greater part of recorded history the chief successive centres of civilization have occupied an extremely limited field of activity and have had only the most imperfect and tardy knowledge of what was contemporaneously taking place within even this small area. Oriental history developed and passed chiefly within the confines of what Professor Breasted has called the "fertile crescent" of the valleys of the Nile and the Tigris and Euphrates. Classical history added to this area of historic activity the coast of the Mediterranean Sea, with a varying depth of hinterland. Mediæval civilization, driven on primarily by the expansive power of Christianity working on the basis of the ruins of the Roman imperial system, brought within the realm of chronicled human endeavor northern and western Europe. While one should not forget the flourishing north European civilization of prehistoric or proto-historic times, which has been revealed by Déchelette, Montelius, Peet, Munro and others, or the advanced and extremely old civilizations of India and China, it is fairly accurate to maintain that up to the opening of the 16th century the great historic civilizations had arisen and had declined, all of them within an area not greater than that of the present United States of America. The subsequent history of the world in its larger aspects has been a process, based upon exploration, colonization and mechanical invention, of extending the area of historical interaction between peoples, of breaking down the earlier localism, isolation, provincialism and stability, and of utilizing the reactions of these changes upon the original European centres of world-wide expansion. See HISTORY, ITS RISE AND DEVELOPMENT (Vol. XIV, pp. 226–232, 253); HISTORY, ANCIENT.

II. The Dynamic Forces Behind the Expansion of European Civilization.— Of all the forces producing the general process of European expansion in modern times, the oldest and most permanent, if not the most important, has been the missionary impulse of Christianity. This has not only been widening the field of European civilization during the period from the fall of the Roman empire to the height of the Middle Ages, but ever since that time it has maintained its energy and activity. As Professors Robinson and Beard have well expressed the matter: "The way for imperialism has been smoothed by the missionaries. There have always been ardent Christians ready to obey the command, 'Go ye into all the world and preach the gospel to every creature.' No sooner was a new country brought to the attention of Europeans than missionaries flocked thither with traders and soldiers." The Crusades (1095–1291) constitute the first notable religious movement which possesses great significance for the subsequent expansion of Europe. While the intellectual and economic results of the Crusades, centring in the appropriation of Arabian culture and the development of trading relations between East and West by the Italian city-states, were much more significant for posterity than the temporary triumph of the Cross over the Crescent, it is certain that without the initial religious impulse there would have been no possibility for the development of the subsequent significant intellectual and economic interaction between Europe and the East which followed the Crusades. In the period of European exploration which ushered in the Commercial Revolution the Catholic missionaries, Franciscans, Dominicans and Jesuits, were in the vanguard of expansion. About the beginning of the 19th century the Protestant missions entered into the campaign of conversion, which has since been in a process of ever greater expansion and more perfect organization. Profoundly impressed with the semi-fanatical conviction as to the uniqueness and the superiority of Christianity over all other forms of world religions, these missionaries have often cut sharply across the theology and the "mores" of the native or Oriental peoples. This has frequently been followed by the persecution or the extermination of the missionaries, which has in turn opened the way for the military intervention of modern governments, driven on by eager capitalists anxiously awaiting the opportunity for investment in these undeveloped areas. As Dr. Dennis, Mr. Macdonald and Prof. E. C. Moore have shown, the missionary movement has ever been closely linked up with the expansion of European civilization and the growth of modern imperialism. See MISSIONS, PROTESTANT FOREIGN; MISSIONS, ROMAN CATHOLIC.

One of the most persistent and effective of all influences stimulating the process of expansion has been the desire to develop more extensive and profitable trading relations. It was the trade which the Italian merchants carrying the Crusaders to the East built up with the Levant that produced the flourishing Mediterranean commercial activity that was both a harbinger and a cause of the later overseas exploration. The jealousy on the part of the western and northern European powers of the Italian monopoly of the trade with the East led to attempts, first made by the Portuguese, to discover another route to the Indies. This resulted in that great era of exploration which brought about the Commercial Revolution and the beginnings of modern world trade. From 1550 to the present day the development of world trade has been one of the most notable dynamic agencies promoting the movement of expansion, particularly since it has been reinforced by the Industrial Revolution, and at the present time it quite overshadows all other stimuli in this field. See COMMERCE, HISTORY OF; COMMERCE OF THE WORLD.

A powerful psychological and political motive for expansion is to be seen in modern nationalism, a force which has been developing with ever greater intensity since the first appearance of the dynastic national states during the 16th and 17th centuries. It was nationalism which promoted the narrow and exclusive economic and political policy, known as "Mercantilism," which dominated European commercial and colonial methods from the close of the 16th century until its overthrow by the economic liberals following the middle of the 18th century. It was nationalism which combined with trade rivalry to produce the series of European wars over colonial interests in the late

17th and 18th centuries. In the period of recent national imperialism since 1870 the nationalistic or patriotic impulse has played a most important part. Territory overseas has been sought as compensation for European losses, as in the case of France; for the purpose of stimulating national pride, as was most evident in the case of Germany; or as a means of providing investment opportunities for national capital, which has been the case with all modern nations, but was most particularly true of Great Britain, the United States and Germany. In the last half century, the period in which the capitalistic party gradually displaced the landlords and became the dominant group in the control of modern governments, patriotic pride in national expansion overseas has been assiduously fostered by the governing classes in order to gain a psychological support for their imperialistic policies. See NATIONAL IDEALS AND THE WAR; NATIONALISM.

All of the motives leading to overseas expansion have been powerfully advanced and given new energy by the Industrial Revolution of the 18th and 19th centuries, which has furnished the perfected mechanism of modern expansion and has greatly augmented the economic motives for imperialistic activity. The vast increase in the productivity of marketable commodities through the application of the machine processes and the factory system has led to the search for more markets. The improved methods of oceanic transportation and of the communication of intelligence have made the search for world markets more feasible and successful. Exploration in the undeveloped regions has revealed the wealth of raw materials to be obtained from these districts, and the increase of available capital has led to a desire to develop the economic potentialities of these backward regions. This has been made easy through the fact that the industrial and scientific revolutions affected the military, as well as the economic field, and provided the modern machines of war which put the natives completely at the mercy of the European invaders. Modern world politics, then, is a great historic complex of ever greater significance, which draws its motive power from the realms of religious fanaticism, commercial ambitions, national pride and the multifarious impulses from modern capitalism. See INDUSTRIAL REVOLUTION, THE.

III. The Commercial Revolution and the First Period of European Expansion. 1. *The Background of the Commercial Revolution.*— While the volume of European trade during the so-called "Dark Ages" was greater than was once supposed, it is true that the earliest notable development of mediæval trade followed the Crusades. The peoples of western Europe desired the edible spices from the Malay Archipelago and the East Indies to make their coarse and ill-preserved food palatable. They further wished to secure the precious stones from Persia and India; the drugs, perfumes, gums, dyes and woods from the Indies, China and Japan; and the draperies, cloth, rugs and fine steel work from Persia and Asia Minor. The desire for these commodities was awakened by the contact with the East during the Crusades and was exploited by the Italian city-states. Their merchants purchased these products which had been brought from the East through the Red Sea, Asia Minor or Turkestan, took them back to Europe and sold them to distributing merchants. It was long a venerable tradition in European history that the occupation of the above-mentioned eastern trade-routes by the Turks following 1453 constituted the chief cause of the downfall of the Italian city-states and of the subsequent development of attempts to discover new routes to the East. Prof. A. H. Lybyer has shown, however, that Thorold Rogers' and M. D'Avénel's statistics of prices following 1453 indicate no appreciable effect of Turkish occupation on the volume or prices of commodities coming from the East to Europe, and further calls attention to the fact that the Turks did not occupy the southern routes until nearly a generation after overseas communication had been established with the Indies. Rather, it seems that the chief cause of overseas exploration was the jealousy of the western and northern European powers and merchants toward the Italian monopoly of the Eastern trade. The Portuguese under Henry the Navigator and Diaz began, in the middle of the 15th century, the explorations which ended in the successful voyage of Vasco de Gama to India in 1498. Under Spanish auspices Columbus discovered America in 1492, and Magellan's fleet circumnavigated the globe in 1519–22. These and contemporary and subsequent explorations opened the way for further expansion and constituted the geographical foundations of the Commercial Revolution and of the dawn of modern history. Along with this major economic impulse to exploration and colonization should be mentioned the religious ambition to convert the heathen, the political desire to increase the territorial possessions and the national prestige of the states of western Europe, and the hope of satisfying that intellectual curiosity which had been developing since the cultural revival of the 12th and 13th centuries. See AMERICA, DISCOVERY AND COLONIZATION OF; COLONIES AND COLONIZATION.

2. *The Rival Commercial Empires.*— The period from 1500 to 1763 in world politics may be most intelligently viewed as the era of the rise and struggles of what has been called the "rival commercial empires." This period started with the rise of the Portuguese to commercial supremacy following the return of Vasco de Gama from India in 1499, and ended with the conquest of the French in North America by Great Britain in 1763. Taking advantage of her priority in explorations in this region Portugal occupied the Spice Islands and several of the East Indies and established a partial monopoly over this valuable trade, but her internal strength was not equal to the strain imposed by this over extensive and rapid external expansion. She lacked the naval power to defend her trading monopoly; she was unable to organize a systematic and competent distributing service for the Eastern commodities; she had few commodities to be taken East in exchange for materials purchased; and a corrupt officialdom made it impossible for her to control unscrupulous traders. Her decline invited foreign aggression, and in 1580 Portugal was annexed to Spain and held in subjection for 60 years. Spain vied with Portugal as an early

contender for colonial and commercial supremacy, occupying the greater part of the New World, especially South and Central America, and several groups of Pacific islands. The great wealth thereby controlled by Spain might have made that country the greatest of modern powers, had it been guided by a wise administrative and fiscal policy, but such wisdom was lacking and the Spanish decline was only slightly less rapid and complete than that of Portugal. The excessively strict regulation of the colonial trade crippled commerce with the mother country and invited smuggling; a cruel and wasteful system of native labor lessened productivity in the colonies; the expulsion of Jews and Moors from Spain lost her the possession of her monied classes, while repudiation of debts forced the withdrawal of German credit; religious bigotry and fiscal exaction lost the rich province of the Netherlands; the Inquisition crushed out all individual originality and initiative; and the loss of the Armada in 1588 meant the end of Spanish naval supremacy. At the beginning of the 17th century Spain was becoming that second-rate power which she has since remained. Stirred to action by Spanish oppression, the Netherlands enjoyed the commercial supremacy of Europe for more than a half century following 1590, occupying most of the old Portuguese possessions in the East, as well as valuable areas in North and South America. But the Dutch were not equal to the task of building up a permanent commercial empire of great extent. Like ancient Athens, the Netherlands were a loosely united group of jealous city-states rather than a compact national unit; the "Spanish Fury" helped to ruin Antwerp and the closing of the Scheldt ended its prosperity; the Dutch devoted their energy chiefly to commercial activity with little attention to permanent colonial policy; and in the contest with England under Cromwell and during the early years of the Restoration the Dutch were thoroughly worsted. France was prevented from making an early entry into the commercial and colonial scramble through the religious divisions that led to the civil wars of the latter part of the 16th century. Even when she did make some systematic attempt to contend as a first-class commercial and colonizing power, her strength was sapped by the suicidal policy of Louis XIV, who at the critical moment wasted the national energy of France in a futile attempt to extend the eastern boundary of that country. France was immensely more rich and powerful than England in the 17th and 18th centuries, but lost out in the final conflict because of a corrupt administration, the failure to devote her resources to the strengthening of her colonies, and the adoption of a fatally weak colonial policy — that of scattered military occupation. England, which emerged from this first period of European expansion as the leading colonial and commercial state of the modern world, was but a small and weak country after its loss of the Continental territory until the time of Elizabeth. Her rising sea-power was based upon the naval training afforded her sailors by buccaneering expeditions against the Spaniards and was proved by the destruction of the Spanish Armada in 1588. The Dutch were vanquished in the middle of the 17th century and the duel of a hundred years with France for colonial supremacy began. Aside from the fact that England took her colonial enterprise seriously and France looked upon it as a "side issue" as compared with the dynastic struggle on the continent of Europe, the chief significance of this century-long contest was that it represented a struggle between two different colonial systems — the intensive occupation and exploitation of a limited area versus the extremely meagre occupation of a vast territory by a few soldiers and traders. In 1688 there were about 300,000 English colonists in the narrow Piedmont region of the Atlantic Coast, while there were scarcely 20,000 Frenchmen in the vast regions of Canada and the Mississippi Valley. With the French handicapped by futile dissipation of energy elsewhere and infinitely weaker in colonial policy, there could be only one issue to the conflict, and by the Treaty of Paris of 1763 Great Britain took over the possession of the great majority of the French colonies in America. See COLONIAL WARS IN AMERICA; COLONY; EXPLORATION IN AMERICA.

But this very triumph of Great Britain over her traditional European enemy only involved her in a more serious struggle with her most important colonial domains, the English colonies of the Atlantic Coast. The occupation of the vast territory conquered from France west of the Alleghenies forced upon England a reconstruction of her hitherto loosely organized and indifferently enforced colonial policy. This imperial organization necessitated additional expenditures, which Great Britain proposed to raise through direct taxation and through an enforcement of the long-dormant navigation laws. But this fiscal policy aroused the opposition of the colonial merchants, long accustomed to unhampered smuggling, and they united with the debtor landlords of the southern colonies to give vitality to that aspiration for independence which Mr. Sydney George Fisher has analyzed with such acumen. The revolution which ensued was in its essence a civil war within the British empire, in which British and American liberals made common cause against conservatives and imperialists in both countries, and the colonial cause prevailed chiefly on account of that defection of the British Whigs which Trevelyan, Fiske and Lecky have clearly recognized and described. The loss of the more important British colonies in America produced a marked tendency toward the granting of greater autonomy in the British colonies that remained. This changing attitude was reflected in the Quebec Acts of 1774 and 1791, the Irish Parliament Act of 1782, and the India Act of 1784, but the thoroughgoing revision of British imperial policy in a liberal direction did not take place until a half century later, following Lord Durham's famous Canada report of 1839. In this first phase of European expansion Germany, Austria and Russia failed to participate, Germany because of the distracting religious wars and Austria and Russia on account of isolation, inertia or propinquity to a vast amount of unoccupied districts in Asia. Their remaining without the circle of the new commercial and colonial powers was most influential in determining the lines of their later political and economic evolution and possessed the greatest

significance for their subsequent history and for that of the rest of the world. It should not be forgotten, however, that Russia was beginning that expansion eastward through Siberia which was to make her an important participant in the second great period of colonial expansion after 1870.

3. *The Larger Aspects and Results of the Commercial Revolution.*—The outstanding effect of the Commercial Revolution and the era of colonization in this first phase was the rude shock which it gave to the mediæval order. It broke down the previous isolation, stability and repetition and gave Europeans a new and ever-varying and extending outlook; in other words, it first introduced the dynamic element and the world-wide viewpoint into western European civilization. It further brought a shifting of the centre of progressive civilization from the Mediterranean Basin to northern and western Europe. The economic effects of the period were varied and profound. Commerce was greatly expanded through its becoming oceanic rather than thalassic and through the entry of many new commodities which had been discovered in the process of exploration. The centres of commerce shifted from Italy to western Europe. With the resulting "intervention of capital" there developed the whole mechanism of capitalistic institutions, a greater supply of money, banking practices, credit instruments and insurance. New types of commercial organization sprang up, such as chartered companies, joint-stock companies and commercial corporations. A definite type of economic theory emerged in what was variously known as Mercantilism, Cameralism and Colbertism, but which in all cases consisted in a strict state regulation of national industrial and commercial activities. Again, there emerged a new class of ever greater proportions, the new merchant group or *bourgeoisie,* who were to play so important a part in the commerce and politics of the age. Finally, probably the most significant economic result of the Commercial Revolution was its preparation of Europe for the most far-reaching transformation in human history, the Industrial Revolution of the 18th and 19th centuries. Through producing a greater supply of capital, introducing and improving the mechanism of credit and banking, developing more scientific and efficient methods of industrial and commercial organization, extending commercial relations and expanding the volume of commerce, opening up new markets, and increasing the power of the business classes in the law-making bodies, with the resulting protection of business interests, the Commercial Revolution alone made possible the coming of the great industrial and social revolution associated with the growth of mechanical industry, the development of the factory system and the rise of the urban age. England led in this new industrial era solely because of her more extensive and successful participation in the previous colonial and commercial activity. In the field of social results there were introduced new standards of comfort; new food products; novel beverages with important social consequences, such as the rise of the coffee-houses and the use of narcotics, especially tobacco. The stimulation of travel and emigration, and a general increase in the mobility of mankind ensued. In the political realm the Commercial Revolution produced the national dynastic states, which were built on the ruins of feudalism by the monarchs through the increase in the royal income and by the aid of the new merchant classes. The new middle class at first supported the monarchs, but later rose against the old order, terminated despotism and established the beginnings of representative government. The rise of the national states and the usages and necessities of commerce led to the development of international law, which was first systematized in the 'De jure belli et pacis' of Hugo Grotius (1625). In the realm of intellectual and cultural influences the effects of the Commercial Revolution were most significant. It gave an irreparable shock to the Patristic and Scholastic outlook and view of man and the world. The discoveries brought to Europe the most prolific and varied types of scientific data, stimulating general scientific curiosity and giving a great specific impulse to the natural sciences, such as astronomy, geography, cartography and biology. The social and moral sciences were also deeply affected, in turn. The discovery of the new types of man produced the origins of anthropology, while the observation of diverse customs and institutions gave rise to the study of comparative jurisprudence, philology, religion and ethics and to the growth of descriptive world history. These combined to develop a philosophy of science, which appeared in the writings of Bacon and Descartes; a secular and human outlook, exemplified in the writings of Montaigne; a eulogy of the state of nature in the early works of Rousseau; and an application of the new concepts to the problems of intellectual and social progress by the English Deists and the French Philosophes. Further, artistic and decorative standards were profoundly modified by the introduction of new designs from the Orient. In short, there were few of the novel trends in thought and culture in the late 17th and 18th centuries which were not in one way or another intimately related to the reaction of the European expansion upon Europe itself. See BANKS AND BANKING—ORIGIN AND DEVELOPMENT; COMMERCE, HISTORY OF; DEMOCRACY, HISTORY OF; HISTORY, ITS RISE AND DEVELOPMENT; NATIONALISM.

IV. The Revolt Against Mercantilism and the Old Colonial Order. 1. *The Background of the Reaction.*— The old colonial system was built up chiefly by the dynastic national states at a time when they were dominated by royal absolutism, narrow chauvinism, and an extremely archaic and fallacious view of economic and commercial theory. It was constructed as much on the basis of a desire to promote an increase of wealth in royal hands as to make possible the maximum expansion of national trade. It was a narrow political and class policy rather than a broad democratic or socialized procedure. Therefore, it naturally aroused the animosity of the merchant classes at home and in the colonies who desired a maximum degree of activity and business. Further, the attempt to enforce this unpopular policy proved expensive, especially in the face of ever-increasing colonial resistance. Finally, the intellectual currents promoted by the Commercial Revolu-

tion tended toward an opposition to mercantilism. The eulogy of the "natural," and the growing belief that social and economic processes functioned most perfectly when in complete conformity with those natural laws which Newton and others had shown to govern the physical universe, combined to discredit so artificial a system as the extensive legislative restrictions on free competition which were embodied in the mercantilistic order. In this way social, economic and political theory were being reshaped so as to reinforce the practical commercial and administrative objections to the old colonial régime. See ECONOMICS.

2. *Economic Liberalism and the Assault on Mercantilism.*— At the same time when the American colonists were offering a successful resistance to British mercantilism in practice, economic theorists were submitting a doctrinal attack upon the foundations of this system. The leaders of the movement were the French Physiocrats and their defender, Turgot; and the English classical economists, with their followers on the continent. This group of so-called economic liberals assumed that economic prosperity and social welfare could best be promoted by securing as far as possible the conformity of economic processes and institutions to that supposedly beneficent "natural order" which was believed to pervade and govern the universe. This conformity would be realized with greatest assurance through ushering in an era of free competition in the economic realm. To do this it would be necessary to repeal the restrictive legislation which had grown up as the basis and essence of mercantilism. Therefore, the practical program of the economic liberals called for a thorough-going abolition of the restrictions on the perfect freedom of the development of industry and trade. Indeed, the Physiocrats held that the chief function of the state, at least temporarily, was the passing of laws repealing the restrictive legislation formerly enacted. While there were important points of difference in the details of the emphasis of this group of writers, varying all the way from the physiocratic eulogy of agriculture to the excessive praise of mechanical manufacturing by J. B. Say, all united in opposing the forcible acquisition of colonial territory and in advocating near or complete freedom of trade. The doctrines of the theorists were warmly espoused by the new capitalistic class which was produced by the Industrial Revolution, as well as by all others likely to benefit by a greater degree of industrial and commercial freedom. In England, Huskisson, and later Cobden and Bright led in the attack upon the old navigation and corn laws, and by 1860 this group had succeeded in bringing free trade to England and in discrediting to a very considerable degree the idea of the advantages of an aggressive imperial policy. The "cosmopolitan dream" of Cobden embodied the acceptance of complete freedom of trade, anti-imperialism and international arbitration. In France the work of Cobden in applying these new theories in the realm of statesmanship was carried on by Guizot, who opposed French intervention in the Levant, and by Bastiat and Saint-Beuve who strove with some success to secure the radical downward revision of the French tariff system, which was realized by the Cobden treaty of 1860 and similar subsequent agreements with other states. In Prussia, Maassen, Bülow, Eichhorn and von Motz carried through the liberal trade policy embodied in the Zollverein of 1818–67. Every important European state was affected to some extent by this reaction against trade restrictions and colonial expansion. But at the very time when free trade and anti-imperialism were receiving the largest degree of practical application great historic changes were beginning to work out their effects in a manner designed to wreck the program of the economic liberals. Nationalism, intensified by the French Revolution and subsequent political events, made for the defeat of cosmopolitanism, while the increased productivity made possible by the Industrial Revolution stimulated that search for additional markets in backward districts which doomed the impulses supporting anti-imperialism. With the French intervention in Tunis and other north African territory and the English purchase of the Suez Canal stock, and with the reaction toward higher tariff schedules which was initiated by the German act of 1879 the day of economic liberalism was over and there began that commercial warfare and that struggle for colonial dominion which, with other co-operative forces, led straight to the European War of 1914. See FREE TRADE; GREAT BRITAIN — THE FREE TRADE MOVEMENT; IMPERIALISM.

V. The Rise and Development of the New National Imperalism since 1870. 1. *The Historical Background.*— One of the most striking phases of the modern dynamic age has been the rise of the new national imperialism since 1870. By this is meant the development of European or American control over the territory or the resources of the less highly developed or the less powerful peoples outside of Europe and the United States, accomplished usually with the sanction or the armed intervention of the states of which the traders were citizens. As a movement this has varied greatly, extending all the way from simply a dominating control over the commerce of a given area to complete political absorption. Perhaps the most conspicuous phase of modern imperialism has been the great swiftness of this European expansion and occupation. More territory has b eenactually procured for European occupation of one sort or another within 40 years than was occupied in the three centuries of the old colonial movement. In 1800 about four-fifths of the land area of the world had not been opened to civilized man through exploration, and as late as 1870 more than half of the habitable surface of the earth had not been touched by Europeans. By the beginning of the 20th century the whole planet outside of the extreme polar regions had been traversed by the white man and its resources and potentialities for exploitation had been catalogued. Africa had been explored and partitioned. Oceania and Australasia had been occupied, and a commercial hegemony of Europe and America had been established in Asia and Latin America. See GEOGRAPHICAL CONQUESTS.

The forces or causes lying back of this expansive movement are conventionally classified as economic, political, social, religious and psychological. The economic causes of expansion grew directly out of the Industrial Revolution. While this movement had affected England and France at a somewhat earlier period,

the great era of industrial development in Germany and the United States was in the years following 1860. This new industry, carried on by mechanical processes under the factory system, gave rise to an unprecedented increase in productivity and to an enormous expansion of capital available for investment. At the same time, the vast improvement in the means of land and water transportation made possible the growth of world trade on a scale which exceeded anything before known, because of cheap transportation, the rapidity with which shipments could be made and the decreased proportion of losses in ocean shipments. All of these developments inevitably led to a scramble for foreign markets and to large scale investment of capital in overseas areas. These markets and areas for investment were sought, when possible, in colonies carved out of backward and unoccupied tracts, and, when these were not available, in seats of older civilizations which had not yet passed into the modern industrial age. Political causes co-operated with the economic in producing the new movement of expansion. The growth of modern nationalism stimulated and intensified the desire to secure and control colonial areas. Italy and Germany had just achieved national unification in 1870 and had developed an intense patriotic fervor which required an outlet in foreign expansion. France turned to foreign areas to secure compensation for the loss of Alsace-Lorraine. Russia, not satisfied with a vast area still awaiting exploitation and development, turned southward to seize more territory in Asia. England had long staked her future on supremacy as a commercial and colonizing nation. Even the United States, before the close of the 19th century, had ocupied all the available free land within its boundaries and turned to the Spanish-American area for a new region of investment and exploitation. This process naturally produced as a sort of psychic compensation the notion of the "civilizing mission" or the "white man's burden," and gave rise to sharp national jealousies over the relative extent of external possessions. Then, there was a strong sociological motive which combined with the political impulses to favor expansion. For some set of causes not yet well understood, but which centre about modern industrialism and the growth of medical science, the population of Europe increased from about 175,000,000 to over 450,000,000 from 1800 to 1915. This led in many countries to a real pressure of the population on the means of subsistence and emigration was stimulated, if not necessitated. It was natural that the mother country should desire to retain a political control over its emigrants and this could be achieved only when they migrated to colonies. Again, the religious motives for developing oversea areas had not declined, but had increased instead. To the Catholic missionaries, who had never ceased activity since the beginning of expansion, were added an ever-increasing number of Protestants. The appeal of the missionaries was further strengthened when it became possible for them to carry with them not only "the word which maketh wise unto salvation," but also modern industrial arts and the blessings of sanitary and medical science. Finally, psychological impulses have served to extend the interests of Europe overseas. The love of adventure has operated as ever, and the compelling power of scientific curiosity has not abated. Again, the social prestige usually attached to colonial service has acted as an incentive to the movement. Further, the various psychological aspects of modern aggressive nationalism have been utilized in the propaganda of skilful and unscrupulous imperialists to effect a popular espousal of their program.

The newer movement of expansion has been national rather than one of persons or privileged companies, and its chief field of operation has been the eastern hemisphere, rather than the western, as was the case with the earlier period of exploration and colonization. Africa, Oceania and Australasia have been forcibly colonized, while economic exploitation has been vigorously cultivated in Asia. This statement does not, however, ignore the extensive commercial exploitation of Latin America by European nations and the United States. The significance of this more recent period of expansion has been vividly described by Professor Shotwell: "Conquistadors, clad in khaki or glittering in helmetted display, have proclaimed to most of the savages of the globe that they belong henceforth to European nations. On the wharves of London there are goods from German workshops for the merchant adventurers of today to carry off to Bantus or Negritos. Piles of coal from Cardiff lie inside the coral reefs of Australasian islands, for the ships which come to break the silence of farther Hebrides than Wordsworth dreamed of. But for the historian there is more significance than romance in such events. The men whom Joseph Conrad and Kipling describe are responsible for the transformation of Africa and Asia. And that transformation in its turn is mainly responsible for those policies of imperial expansion, of commercial and colonial rivalries which underlie the causes of the present war." The effects of the new imperialism upon the political and diplomatic events and tendencies of the last half century in Europe have been most profound. Scarcely a dominating alliance or an armed conflict has existed which has not been more or less directly a result of overseas policies and ambitions, while these policies have very frequently even determined the characteristics and trends of domestic politics, as well as the destinies and careers of statesmen.

While it cannot be doubted that much of the older policy of thorough-going exploitation has been carried over into the new imperialistic movement since 1870, it is certain that a somewhat higher moral level has prevailed in the activities of the colonizers. There has been at least some rhetorical, though often hypocritical, recognition of a moral obligation in the "white man's burden" and of the duty of elevating the cultural standards of the natives. There can be no question that even Karl Peters and the agents of Leopold of Belgium treated the natives of Africa with a greater degree of fairness and honesty than can be discerned in the relations of the Puritans of New England with the Indians of the district. See HISTORY, MODERN; INDUSTRIAL REVOLUTION; NATIONALISM; POPULATION, GROWTH OF; MISSIONS.

2 *The Rediscovery and Partition of Africa*

The Explorations — Africa has during historic times presented great ethnographic contrasts, her inhabitants varying all the way from what

ethnologists now believe to have been the original North African ancestors of the white race to the pygmy Negrilloes of the equatorial forests The cultural contrasts have not been less marked. At least three times in historic eras, in ancient Egypt, in the Alexandrian Age, and during the Saracen hegemony in the Middle Ages, northern Africa was the seat of the most advanced type of human culture, while the districts south were at all times inhabited by some of the most backward of savages. Down to 1870 Europeans had made little progress in the way of opening up the African continent. The Arabs had pushed southward along the coast carrying with them the propaganda of Islam and developing the deplorable slave trade. In the middle of the 15th century the Portuguese began their explorations which were to carry them around the Cape of Good Hope to India. In the 17th century the Dutch tended to displace the Portuguese, and after 1795 the English began to make inroads upon the Dutch settlements. Despite some scattered trading posts the French made no permanent conquests of importance until the acquisition of Algeria following 1830. Spain possessed a few trading posts of little consequence, and Prussia in 1720 abandoned the settlement made on the coast of Guinea by the Great Elector in 1681. Yet all of these advances, significant as they were, had failed to penetrate more than a narrow and incomplete fringe around the western and southern portion of the continent. But on the eve of the new imperialistic developments following the "70's" scientific curiosity, religious propaganda, and journalistic enterprise were leading men to carry on those epoch-making explorations which revealed to enthusiastic European and American capitalists the economic and commercial potentialities of the "Dark Continent." This process of exploration has been clearly summarized by Professor Harris: "Fortunately, at the time when the European states began to think seriously of colonial expansion, the interest of Europe in the Dark Continent, as a field for commercial and economic activity, was aroused to a degree never before known. Considerable information existed concerning certain portions of Africa and its general contour, for, in the 40 years prior to 1870, a large part of the continent had been explored; but few persons, except scholars and geographers, had taken particular notice of it. Before 1880, indeed, Mungo Park, Major Laing and M. Caillé had gone from the west coast up the Gambia and Senegal rivers, found the upper waters of the Niger and Timbuctu and crossed the Sahara to Tangier and Tripoli, while Clapperton and Denham were exploring the Central Sudan from Lake Chad to the Niger River, and the brothers Lander down that stream to its mouth. Dr. Henry Barth spent the years 1850 to 1855 in the scientific study of the language, peoples and geography of the region just mentioned (west of Lake Chad) including the kingdom of Sokoto. Farther south, on the east coast, Paul du Chaillu traveled over the Gaboon River district between 1856 and 1868; and, in the interior, David Livingstone explored the Zambesi River, the region about Lakes Nyasa and Tanganyika, and crossed the continent to Benguella during the 18 years following 1851. Meanwhile, Burton, Speke and Grant, coming up from the east coast, had discovered Lake Victoria Nyanza and the headwaters of the Nile; and Sir Samuel Baker, traversing the whole of that river from the north to the south, found its other source in Albert Nyanza. But it was the work of Dr. Nachtigal, who in 1869 to 1871 studied carefully the eastern Sahara and Sudan; of Cameron, who crossed the whole continent from the Zanzibar Coast to Benguella between 1873 and 1875; of Savorgnan de Brazza, who explored scientifically the whole region between Libréville on the Gaboon and the north banks of the Kongo and Ubangi rivers from 1874 to 1884; and of Henry M. Stanley, who found Livingstone in 1873, that drew the attention of the general public to Africa. Books were written, money raised, and colonial societies formed with the purpose of inducing people to study African conditions and to start colonies. By the time Stanley returned from his second journey in 1877, with the news of the discovery of the great Kongo River and its tributaries, the statesmen and the intelligent public of Europe were taking a very considerable interest in African affairs. The general topography of the continent had been mapped,—in outline, at least,—the location of all the important lakes and waterways pointed out, and the possibilities of the different sections as sources of wealth and trade for Europe ascertained with a fair degree of accuracy." See AFRICA.

About a decade after most of the great African discoveries had been concluded the diplomatic and legal basis for the partition was arranged by the Berlin Conference of December 1884 to February 1885. The slave trade was branded as illegal; formal notice was ordered given of all protectorates assumed; it was declared that no terrritory should be annexed which was not "effectively occupied"; freedom was prescribed for all nations in the navigation of the Kongo and Niger rivers; and provision was made for general freedom of trade in the Kongo Basin. No systematic provision, however, was made for carrying out the "white man's burden" of advancing the cultural and moral status of the natives.

Leopold of Belgium and the Episode of the Kongo Free State.—The first notable apostle of modern capitalistic imperialism to Africa was none other than King Leopold II of Belgium. His interest was aroused by Stanley's first report of his African explorations in 1876. Under Leopold's leadership an "International Association for the Exploration and Colonization of Africa" was formed in the autumn of 1876. Two years later Stanley returned from a second exploring tour and conveyed to Leopold's agents an account of the natural resources of the Kongo district in rubber, palm products, ivory and various tropical woods, gums and fibres. Stimulated by this information Leopold developed through the Belgian branch of the International Association the "Committee for the Study and Investigation of the Upper Kongo" (1878), which employed Stanley for the next few years in making a detailed geographic and economic survey of the Kongo district. In the meantime, Leopold carried along his plans to obtain full political and economic control of this region In 1882 he organized the "International Association of the Kongo," with himself as president. Between April 1884 and February 1885, in part by

intrigue at the Berlin Conference of 1884–85, he secured from the great powers the recognition of the International Association of the Kongo as an independent sovereign state, and in April 1885 he realized his full ambition by transforming it into the "Kongo Free State" with himself as its king. It should be kept in mind that Leopold was not the sovereign of the Kongo Free State in virtue of his position as king of Belgium, but that the African district was his own private possession. While Leopold persistently maintained that this enterprise was founded primarily upon the desire to bring to the natives of the Kongo district the blessings of Christian civilization, his actual administration, especially in its economic phase of forced labor, was one of the most notorious examples of cruel and extortionate exploitation of a backward people of which modern history bears any record. Protests, begun by missionaries who were greatly handicapped by the difficulty of spreading the gospel in the face of the concrete demonstration of the methods of the "most Christian King," were taken up by leading nations who were motivated in part by humanitarian considerations and in part by commercial jealousy of Leopold's financial profits from his African patrimony. Revelations of extreme cruelty, made by English investigators in 1902 and 1904, were confirmed by an international commission in 1905, and the strength of indignant public opinion in Europe and America, including liberal Belgian opinion, forced Leopold to surrender the Kongo Free State to the Belgian government in 1908, in return for an ample indemnity. Since the establishment of Belgian control, not only has the political administration been greatly improved and liberalized, but also the commercial importance of the district has been greatly increased under more generous concessions to merchants and capitalists from Belgium and other states. See AFRICAN INTERNATIONAL ASSOCIATION; KONGO.

German Colonial Enterprise in Africa.— For a number of historical reasons Germany was extremely tardy in her entry into the colonial movement. Though the Great Elector had begun a policy of colonial expansion and naval development in the latter half of the 17th century, the agrarian fixation of the Prussian Junkerdom had led his successors to abandon these beginnings. The persistence of the mediæval empire, the lack of national unification until 1870, and the absence of significant industrial and commercial expansion down to the '70's had served to prevent Germany from being a contender in the old colonial movement. Even as late as 1870 Bismarck had opposed overseas expansion and had declared that he would not accept the entire French colonial empire as a gift. But forces were at work in Germany which made Bismarck's opposition ineffective and which produced one of the most enthusiastic and aggressive policies of colonial expansion witnessed in modern times. The unprecedented industrial development during the decade following 1870 and the exuberant patriotism produced by the process of unification created an overwhelming desire for world markets and a prominent colonial dominion. This movement was initiated by private merchants and capitalists, but at a slightly later period they won over the government to that co-operation in building up German commercial expansion which resulted in the phenomenal success of German officials and merchants in securing a great proportion of the trade of the world and in erecting a very respectable colonial empire. While German missionaries had explored the southwestern coast of Africa in the middle of the 19th century and German steamship companies had begun a desultory trade along the coast shortly afterward, the real awakening of German interest in imperialism came about in 1878, when the German branch of the International African Association was established. In 1882 a society for the development of *Weltpolitik* was founded as the German Colonial Union, and two years later several mercantile marine companies and colonial societies openly sponsored a program of commercial and colonial expansion. Within two years after 1884 Germany had acquired what was substantially the basis of her African domains. In each case the territory was acquired by government explorers or by representatives of private commercial or colonial societies, and then Bismarck was won over to annexation through the pressure of national pride or foreign opposition. Dr. Gustav Nachtigal, the noted explorer, negotiated for the possession of Kamerun and Togoland in 1884 and both were taken over as a German protectorate in 1884. F. A. E. von Lüderitz, a Bremen merchant, in the summer of 1883 purchased what became German Southwest Africa when it was taken over by the German government in the next year. Karl Peters, one of the most blatant of Pan-Germans and a representative of the German Colonial Society, acquired German East Africa in 1884, and his activity was approved and confirmed by the government in 1885. This German territory in Africa, totaling slightly over 1,000,000 square miles, was later defined in its boundaries and somewhat extended in the Anglo-German agreement of July 1890 and the Franco-German arrangement of November 1911 respectively. In a financial sense the German colonies have not been a profitable investment, though Kamerun and East Africa gave promise of developing into fruitful areas for economic exploitation. The general nature of the German colonial administration in Africa may best be described by dividing it into two periods, that before and that after the reconstruction of the administrative system in 1906–07. In the earlier period the administration was under the control of chartered companies, not unlike the famous British East India Company. A policy of ruthless exploitation, more perfect in its refinement of cruelty than that of Leopold in the Kongo district, was followed during this period, but in the same way that the Sepoy mutiny of 1857 led Great Britain to transfer India to the Crown, so the frightful Herero wars of 1903–06 and the massacre of the natives in East Africa in 1905 forced the German government to undertake a sweeping reorganization of their colonial policy and administration. A colonial office was established in 1906 and Dr. Bernhard Dernburg took charge as colonial secretary in the following year. After 1907 the oppressive methods were abandoned and a systematic attempt made to introduce the essentials of Western civilization into these colonies, including transportation systems, scientific forestry work, sanitary science and some degree of elementary

education. It must frankly be admitted that no other country has governed its African colonies of the same level of culture in a more efficient and enlightened manner than Germany since 1907, and the deprivation of Germany of her African possessions by the Peace Conference was one of the least justifiable acts of that body and perhaps the best proof that colonial booty, as well as the safety of the democratic principle in the world, weighed heavily upon the attention of the Allied powers. See GERMANY — GERMANY AND THE WAR.

Great Britain and the Boers in South Africa. — The original white population of South Africa was a colony of Dutch farmers, called Boers (from the Dutch term for peasant), who settled at Cape Colony in the latter part of the 17th century. The region was permanently occupied by the British in 1806. On account of religious and linguistic differences, the extension of political equality to the native blacks, and, above all, the arming of the natives, the Boers found existence under British domination intolerable, and in 1836 under the leadership of Peter Retief they began their "Great Trek" across the Orange and Vaal rivers toward Natal, where they established a Boer republic in 1838. After some vicissitudes respecting political independence two Boer republics, the Transvaal and Orange Free State, had emerged by 1854. Nothing of consequence happened in South African politics from 1854 to 1877, when Disraeli, in the first enthusiasm of the new British imperialism, annexed the Transvaal. This led to the first Boer War of 1881 which ended in the complete defeat of an insignificant British force at Majuba Hill in 1881. This victory, combined with Gladstone's grant of independence, produced a great inflation of Boer national pride and did much to create that inflexible Boer stubbornness which furnished the chief pretext for British intervention in 1899. The significant background of the Boer War was provided through the great influx of foreigners following the discovery of the rich gold and diamond mines in the Boer republics in the "80's." By 1896 these foreigners or "Uitlanders" had come to own two-thirds of the land and about 90 per cent of the personal property in this region, and paid about 95 per cent of the taxes. In spite of this they were excluded from political rights and subjected to extortionate taxes and irritating economic restrictions. Despairing of their efforts to secure enfranchisement by legal means some of the more daring Uitlanders, encouraged by Cecil Rhodes and led by Dr. Leander S. Jameson, attempted in an ill-starred raid to overthrow the Boer government and supplant it by Uitlander control. While this wild escapade failed miserably, it had consequences of the utmost importance for South African history. The Boers grew more suspicious and intolerant, and the Uitlanders came to put their trust more and more in the hope of British intervention in their behalf. Matters were still further complicated by the German kaiser's ill-considered congratulatory telegram to President Kruger following the capture of Jameson, which did much to create greater tension between Germany and England. In March of 1899 the Uitlanders appealed to Great Britain for relief, and the British commissioner, Sir Alfred Milner, advised intervention. When it was too late Kruger agreed to the long-sought reforms, but Great Britain had then resolved upon war. To crush the Boers Great Britain was compelled to put more soldiers in the field than ever before in her history and the war was the most expensive she had ever undertaken, with the sole exception of the series of conflicts in the Napoleonic period. Her action was bitterly opposed at home by liberal statesmen like Lloyd George and by progressive publicists like J. A. Hobson. The triumph of the British Liberal party in 1905, however, brought into power the group that had opposed the war, and a liberal policy of conciliation was immediately adopted. A constitutional convention for South Africa was held from October 1908 to June 1909. It drew up a constitution for the Union of South Africa, which was approved by Great Britain on 20 Sept. 1909, and the Union — a new self-governing colony — was thereby created out of Cape Colony, Natal, Orange Free State and the Transvaal. While the Boers have dominated the government, their interests have been in the hands of moderate and statesmanlike leaders, most notably Gens. Louis Botha and Johannes Smuts, who have recognized that the future prosperity and peace of the Boer people depend upon an avoidance of the narrow intolerance of the Kruger régime. Their loyalty was vindicated when in the autumn of 1914 they speedily repressed a nationalist revolt, encouraged by the German emperor and led by Hertzog, Beyers, De Wet, Maritz and other irreconcilables. Botha and Smuts participated with credit in the conquest of the German colonies in Africa and General Smuts was generally recognized as easily the ablest and most far-sighted representative of the Allied powers at the Peace Conference. The economic prosperity of South Africa still rests chiefly upon the gold and diamond products, though livestock and wool have become prominent products in recent years and some considerable development of manufacturing industry has taken place. Immense coal reserves exist, but iron ore is lacking. The economic expansion of the colony has been handicapped by the lack of an adequate and competent labor supply. Native labor has been inefficient; the introduction of Chinese labor proved an unsuccessful experiment in 1904–05; and the importation of labor from India which followed was abandoned in 1911. See BOERS; GREAT BRITAIN — FOREIGN POLICY IN AFRICA AND AMERICA.

Great Britain in Egypt and the Sudan. — The interest of modern Europe in Egypt was first stirred by Napoleon's romantic campaign there in 1798. French interest survived during the first half of the 19th century, and in 1869 a French engineer, Ferdinand de Lesseps, completed the Suez Canal. Great Britain turned her attention to Egypt following the explorations of Baker and others in the "60's." She had particular reasons for desiring a dominating control over the Suez Canal. In addition to the general commercial advantages to be derived from its control, it provided the shortest water-route to India and Australasia, and Great Britain could scarcely regard with complacency the spectacle of a rival in possession of so vital a point for British imperial communication. A fortunate combination of circumstances — the French defeat and indemnity of 1870 and the contemporaneous bankruptcy of the khedive

— made it possible in 1875 for Disraeli to purchase some 177,000 shares of canal stock from the khedive for £4,000,000 ($20,000,000) after France had refused the offer. The reckless financial operations of the khedive led to the establishment of a dual control over Egyptian finances by Great Britain and France in 1877. Some five years later an Egyptian nationalist revolt broke out, led by native officers who were restive under the domination of foreigners. France was prevented from intervening to suppress the revolt by the opposition of Clemenceau and other radical anti-imperialists, and Great Britain had to crush the revolt unaided in the summer of 1882. The result was to exclude France from a parity in the control of Egypt and to make Egypt practically an English protectorate, although this relationship was not formally proclaimed until 18 Dec. 1914, and Egypt was controlled during this period by a British "financial adviser" (Lord Cromer, 1883–1907; Eldon Gorst, 1907–11; Lord Kitchener, 1911–14). The British occupation has brought great material advantages to both Egypt and Great Britain. Archaic and oppressive native customs and institutions have been uprooted; new industrial methods have been introduced; great public works, especially irrigation projects, have been completed; and the finances have been put on a stable and scientific basis. Great Britain has been rewarded by the possession of not only the key to the British empire, but also the basis for the development of her interests in the "Cape-to-Cairo" project and for the extension of her dominion in western Asia and Arabia, and by the control of the foreign trade and the valuable cotton crop of Egypt. See EGYPT.

South of Egypt is the great district of the Sudan. Nominally under Egyptian control, the inefficiency of that administration enabled a group of Mohammedan fanatics under El Mahdi to secure control of that region and to massacre the distinguished English soldier, Gen. Charles George Gordon, and his forces at Khartum in January 1885. Gladstone took no active steps to avenge the murder, but by 1896 some action was rendered necessary to protect Egypt from invasion and to safeguard the Egyptian water-supply. This task of conquering the Sudan was entrusted to Gen. Horatio Herbert Kitchener, who completed the conquest on 2 Sept. 1898 and received as his reward elevation to the peerage. The British conquest of the Sudan was followed by a diplomatic crisis of the first importance for subsequent history. At the same time that Kitchener was subduing the Sudanese a French force under Marchand was moving eastward across Africa to the sources of the Nile, and it arrived at Fashoda in the lower Sudan on 12 July 1898. Pushing southward after his victories Kitchener reached the same spot about two months later. War was imminent, but the skilful handling of the situation by the French foreign minister, Delcassé, not only averted hostilities, but also secured a potential Anglo-French alliance which was still further strengthened in 1903–04, confirmed in 1911 and given practical demonstration in 1914. The World War completed the occupation of the Egyptian area by the British. Turkey's action in joining the Central Powers in November 1914 furnished the pretext for the British declaration of the Egyptian protectorate on 18 Dec. 1914. The seizure of German East Africa by Great Britain and the approval of this action by the Peace Conference gives Great Britain unobstructed control of a broad strip of territory from Cairo to Cape Town and assures the future hegemony of Britain in African imperialism. At the same time, her domination of this district probably will not remain unchallenged on account of the persistence of a strong Egyptian nationalist movement which is not likely to subside. See KITCHENER, HORATIO HERBERT; SUDAN.

French Imperialism in Africa — The earliest centre of French interests in Africa was Egypt, but, as has been pointed out above, France was excluded from Egypt by British action in 1882. In the meantime, however, France had been laying elsewhere the basis for the great French colonial dominions in Africa. Algeria was conquered in the Orleanist period (1830–48). Settlements were made at Gabun following 1840 which opened the way for the colonization of French Equatorial Africa. At the same time posts were located on the Ivory and Guinea coasts which prepared the way for the French expansion in the Senegal and Niger regions. Entry into Somaliland after 1864 put in French hands the key to the lower end of the Red Sea and to the Gulf of Aden. Tunis was made a protectorate in 1881, and Italy was thereby estranged from France and impelled to enter the Triple Alliance with Germany and Austria. By the Anglo-French agreement of 1890 French possession of the Sahara district was confirmed and a protectorate allowed over Madagascar, which was transformed into a French colony in 1896. In the early "90's" the French extended their possessions in the Senegal, Niger and Kongo districts, and by the Anglo-French agreement of 1899 France acquired the central Sudan and was enabled thereby to connect Algeria and the Sahara with the French Kongo. In 1900 and 1902 Italy agreed to a French protectorate over Morocco in lieu of French consent to Italian occupation of Tripoli, and in 1904 Great Britain gave her assent to the Moroccan protectorate in return for a French willingness to see a British protectorate proclaimed in Egypt, but at this juncture Germany took a hand and the dispute over Morocco threatened the peace of Europe for some seven years. Early in 1905 the German emperor landed at Tangier and hailed the sultan of Morocco as an independent prince, thereby ignoring or defying French interests in that country. France was not able to accept the challenge on account of Russian weakness at the time and the dispute was temporarily settled by the Algeciras Conference of 1906. But the French were unwilling to cease their political penetration and the German economic interests pressed their government for more vigorous action. A second serious crisis arising over the action of the French and German authorities at Casablanca was settled without hostilities through referring the dispute to The Hague. A more serious crisis arose three years later when, as a counterpoise to the French occupation of Fez, a German naval force seized the port of Agadir. War was only averted by a definite statement from the British foreign office that Great Britain would stand with France in the controversy. Germany backed down and agreed to the convention of November 1911, whereby she gave France a

free hand in Morocco in return for a cession of a part of the French Kongo. Accordingly, France transformed Morocco into a French protectorate between 30 March and 28 Sept. 1912, and thereby rounded out her possession of the most of northwestern Africa. See FRANCE—FRENCH COLONIES, MOROCCO.

Italian Imperialism in Africa.—The Italians, ever mindful of the classical glories of Italy, were unable to forget that northern Africa had once belonged to the Roman empire. In the very year of the occupation of Rome by Victor Emmanuel's army Italy acquired the foothold on the Red Sea which soon developed into the colony of Eritrea. In 1889 the Italians occupied Italian Somaliland and attempted to reduce the neighboring region of Abyssinia to a protectorate. In this they were unsuccessful and a stinging defeat at the hands of Menelek in 1896 caused the resignation of Crispi, the leader of Italian imperialism, and forced Italy to desist from further attempts to control Abyssinia, the independence of which was guaranteed by international agreement 10 years later. Italian attention was next centred upon Tripolitania, the choicest bit of north African territory which remained after Tunis had been lost to France. Agreements of December 1900 and November 1902 secured French consent to aggressive action in this area. An ultimatum sent on 28 Sept. 1911 to the sultan of Turkey concerning reforms in Tripolitania brought on war. Superior Italian forces, together with Turkish embarrassment in the Balkan War, led to the treaty of 18 Oct. 1912, by which Italy obtained formal control of Tripolitania, or Tripoli, Libya and Cyrenaica—the "gateway to the Sahara." There is, however, some doubt as to whether the territory was worth the price paid by Italy in the expensive war of 1911–12, and Italy has not yet succeeded in reducing the natives to complete subjection.

Other African Territory.—The African territory which has been described above is all that has borne any great significance for world politics. A mere summary enumeration will serve to account for the remaining districts. In addition to that already enumerated Great Britain possesses Gambia, Sierra Leone, the Gold Coast, Nigeria and Walfisch Bay in western Africa; Bechuanaland and Rhodesia in south central Africa; and British East Africa, Uganda and British Somaliland in eastern Africa. To these areas should now be added the most of the colonial possessions of Germany before the war. Portugal retains out of her former African possessions, Guinea, Angola and Portuguese East Africa. Spain has on the western coast three small areas of domination, northern Morocco, Rio de Oro and Rio Muni. Finally, there are the independent states of Liberia, founded in 1817 under American auspices as a colony for emancipated slaves, and Abyssinia, a native Christian kingdom with its independence guaranteed by an international agreement of 1906. Thus, from an almost untouched continent in 1870 Africa has passed into a well advanced and completely partitioned area for imperialistic exploitation. Its great natural resources will inevitably result in its ultimate development as an important economic factor in modern civilization, once these resources are utilized by the methods of Occidental material culture. See AFRICA.

3. *Modern Imperialism in Western Asia—The Berlin-Bagdad Railroad and the "Drang nach Osten."*—Among the various plans for imperialistic expansion since 1870, none has been more interesting or significant than the attempt of the German empire to gain control of the resources and means of communication in Asia Minor and Mesopotamia, generally known as the Berlin-Bagdad Railroad or the "Drang nach Osten" plan. There were numerous considerations which impelled Germany to undertake this program of expansion. It meant that Germany would possess the central and most direct commerical route to the Orient and India and that she would also be enabled to develop the rich natural resources of this region. It would be, further, of great strategic value, as it would give Germany a naval base on the Persian Gulf, would put her in a position to strike quickly at either India or Egypt, and would make her the natural heir of British dominions in this area. The first necessary move in carrying through this project was to displace England as the traditional protector of the sultan and the Turkish domains. In 1878 Bismarck took a prominent part in the Congress of Berlin which set back the Eastern Question for 40 years and saved the Turkish empire from partial dismemberment. In 1883 General von der Goltz went to Constantinople and led in the reorganization of the Turkish army according to the German model. In 1897 the emperor took Von Bieberstein out of the German administrative system and sent him as ambassador to Turkey, where, in the ensuing 15 years, he proved himself the most astute German diplomat since Bismarck. A year later the emperor himself made an ostentatious visit to Turkey, honoring the sultan and proclaiming himself upon the grave of Saladin at Damascus the "eternal friend of the 300,000,000 Mohammedans in the world." The friendship of the kaiser, together with the subtle diplomacy of Bieberstein, won for Germany the Turkish consent to the building of a railroad from Konia in western Asia Minor to Basra on the entry to the Persian Gulf. A very considerable volume of international opposition to the project developed. Russia feared German activity in the Balkans and in the Caspian and northern Persian region; France was fearful lest this might threaten her financial and railroad interests in Syria; England was suspicious lest the scheme would cause the bankruptcy of Turkey and a subsequent German protectorate and would threaten both India and Egypt, not only through a possible direct German attack, but also through German encouragement of the dangerous nationalistic sentiment in both of these regions. Only a few Englishmen like Sir Harry H. Johnston favored the project as the least dangerous outlet for German energy. These objections were, however, in the main removed by diplomatic activity. Russia was placated after a meeting of the tsar and the kaiser in November 1910, which arranged an agreement made public on 19 Aug. 1911. French objections did not prove serious, and a satisfactory adjustment was made with Great Britain on 29 June 1914, which safeguarded British interests in the East and gave Germany the desired transit rights. The actual building of the railroad proceeded slowly and was often interrupted by financial and diplomatic obstacles. A

German engineering company had constructed for Turkish interests a railroad from Ismidt to Angora following 1888. In 1896 a southern branch was built from Eskishehr to Konia and either a southern or a northern route was thereby made possible from Konia or Angora. Russian opposition to the northern route led to a favoring of the southern line. In 1899 the Turkish government gave Germany the desired railroad concession, which was confirmed by the sultan's *Firman* of 1903, establishing the Bagdad Railway Company as a Turkish corporation with a majority of German directors, and extending permission to build the railway to the Persian Gulf. The company had hoped to sell the Turkish government bonds, issued to build the railroad, to French and English, as well as German, investors, but the methods of financing the project and the German domination of the enterprise discouraged French and British investment and the project had to be halted until a sufficient sale could be effected elsewhere. This was accomplished by 1908, but the "Young Turk Revolution" broke out in that year and caused a cessation of the work. Arrangements for resuming the construction were made with the Turkish government in March 1911, and work was begun soon afterward. In the months just previous to the outbreak of the World War construction was greatly hastened and since 1914 the work has progressed very rapidly. Several great engineering feats have been accomplished, especially tunnels under the Taurus Mountains and a great bridge over the Euphrates. Over 1,100 out of 1,500 miles to Bagdad have been constructed and about 165 of the remainder can be covered by water on the Tigris. The hastening of construction at and before the outbreak of the war proved of great strategic value to the Central Powers. It enabled rapid Turkish mobilization to protect Constantinople and the Caucasus district and to attack Egypt. Danger to India and Egypt compelled the undertaking of the British Mesopotamian and Western Asian expeditions that early met with disaster, but which later gained a sweeping victory under General Allenby in the autumn of 1918 and put Turkey out of the war. Whatever the specific arrangements as to mandates over this area, it seems perfectly evident from the Anglo-French agreement over Syria, announced 16 Sept. 1919, as well as from the Anglo-Persian agreement of 9 Aug. 1919, that France and Great Britain will take over the former German interests in this region. See BAGDAD RAILWAY; MESOPOTAMIA.

Great Britain and Russia in Western Asia.— The history of Persia in modern times has been one of the most revolting on record, the government not being one in which tyranny was tempered by assassination, but one in which tyranny reveled in assassination and massacre. It was inevitable that in such an environment industry and commerce could scarcely thrive under the control of domestic authorities and that such an internal situation would invite foreign aggression. The natural contenders for this district were Russia, working southward from European Russia and Siberia, and England slowly converging from India and Egypt. Russian occupation of Persian territory developed after 1722, when the northern provinces were seized, and by the close of the third quarter of the 19th century Russia had occupied all Persian territory as far south as the southern end of the Caspian Sea. British invasion began in 1856, and, while no territory was permanently occupied, Great Britain developed a firm hold upon Persian finances and commerce after her entry into these fields in 1873, 1887 and 1889. From the close of the Napoleonic wars both England and Russia were jealous contenders for the control of Persia. This colored the allied activity in the Greek War of Independence (1827); brought on a general European conflict in the Crimean War of 1854–56; produced Disraeli's sinister interference with the treaty of San Stefano in the short-sighted readjustment at the Congress of Berlin (1878); and constituted the cause for Great Britain's unsavory protection of the "intolerable Turk." After considerable friction, as well as the development of alliances between France and England, and France and Russia, the rivals finally decided to terminate their disputes by a partition of the coveted territory. This was achieved by the Anglo-Russian agreement of 31 Aug. 1907, dividing Persia into two spheres of "influence." Northern Persia was put under Russian domination and the southern portion in control of Great Britain. An intermediate or neutral zone was created in which both powers might operate. Germany was placated in part by securing the withdrawal of Russian opposition to the Berlin-Bagdad project, while France was sufficiently consoled by the compromise and unity thus effected between her two powerful allies. It fell upon Persia to pay the price of the realization of the "Drang-nach-Osten" plan and the consummation of the Triple Entente. While a nationalist revolution of 1908–09 endeavored to free Persia of foreign aggression and intrigue, and an American financier, Morgan Schuster, attempted to put the Persian finances on a sound footing in 1911–12, neither was able to shake off the Anglo-Russian incubus and Persia was successfully "strangled" down to the outbreak of the World War. The only apparent result of the war upon the fate of Persia is that Great Britain has taken advantage of Russian weakness and Russian repudiation of her part in the agreement of 1907 to extend British influence over that part of Persia formerly dominated by Russia. The agreement of 9 Aug. 1919, between England and Persia practically established a military and financial protectorate over Persia. See PERSIA; RUSSIA; RUSSO-TURKISH WARS; SIBERIA.

Russia and Great Britain came into conflict not only in Persia but in Afghanistan, immediately to the east. Russia had pushed southward and occupied western Turkestan by 1895. Nothing stood between Russia and India except the relatively small state of Afghanistan, and Great Britain, failing to capture it for herself, bent all her energies to maintaining its independence as a buffer state between India and Russian Turkestan. An agreement of 1880 gave Great Britain control over the foreign affairs of Afghanistan, and the boundary of this state on the north was adjusted with Russia in 1885. In 1907 a further agreement was made between Great Britain and Russia whereby the commercial equality of both states in Afghanistan was guaranteed, Great Britain was left in full control of the foreign affairs of the district, and

the immunity of Afghanistan from annexation or occupation was safeguarded. Russian power in this region has waned since the Revolution of 1917, but the Amir has made little progress in obtaining freedom from British domination. See AFGHANISTAN.

Britain in India.— The place of India in modern imperialism is particularly interesting on account of the complicated situation which arises from the fact that within this vast and densely populated area, imperfectly described as India, there are included not only some of the most primitive peoples now in existence, but also one of the oldest and richest of historic cultures. In the earlier part of the old colonial movement Portugal, Holland, France and England aspired to control parts of India, but the final rivalry for European control lay between Great Britain and France. This was decided by Clive's victory at Plassey in 1757, Coote's triumph at Wandewash in 1760, and the subsequent capture of Pondicherry. By the treaty of 1763 France lost her Indian possessions, along with most of those in America. During the 19th century the British occupation of India proceeded. The Mahratta confederacy was overthrown in 1816–18; Nepal was overcome in 1814–18; Burma was conquered in successive portions in 1826, 1852 and 1885; the Sind and Punjab areas were taken over in 1843–49; Sattari, Jhansi, Nagpur and Oudh were annexed in 1852–56; Baluchistan was added in 1887; while Tibet was successfully "penetrated" in 1904–14. The development of the administrative machinery proceeded parallel with territorial acquisition. The corruption that had crept into the management of Indian affairs by the East India Company (founded 1600) was curtailed by the Regulating Act of 1773, which provided for Parliamentary supervision through a supervisory council. Eleven years later, by the Indian Act of 1784, this governmental supervision was extended through the nomination of officials for the Indian service by the ministry and by the creation of a board of control in London. This act, with minor amendments, governed Anglo-Indian relations until the Sepoy Mutiny of 1857. In this year the native troops, alarmed by continued British aggression in India, irritated by British interference with native customs, and enraged by the introduction of new ammunition which offended their religious prejudices, arose in a rebellion which was put down only with the greatest difficulty. The mutiny was a sufficient lesson to British statesmen. They terminated the control of the East India Company in 1858 and transferred the administration to the Crown. A secretary of state for India was created and the local administrative control was given to a viceroy appointed by the home government. There is, of course, no uniformity in the government of India, some districts being under the direct control of British administrators, while others are ruled wholly by native princes under only the most casual British oversight, which is concerned chiefly with the prevention of rebellion. In 1877 Disraeli had Queen Victoria formally declared the empress of India. The growth of Indian nationalism in the late 19th century led to the Indian Councils Acts of 1892 and 1909, which allowed a greater degree of native representation in both central and local governing bodies. In spite of these concessions, however, the nationalist movement has continued to thrive, though it had not developed sufficiently to secure Indian independence during Britain's hour of weakness in the World War. The chief obstacle to the nationalist cause is the great diversity in the population of India in race, religion and degree of civilization, which makes unified native action well-nigh impossible. While Great Britain was extremely remiss in granting promotion to brave Indian soldiers in the late war, she did indicate some gratitude for Indian loyalty by allowing Indian representation in imperial conferences on something approaching a parity with the self-governing colonies, and by promising, and to some extent executing, administrative reforms in India. The Amritsar massacre in the Punjab region in April 1919, where about 500 natives were killed and a much larger number injured by British troops, not only indicates the persistence of a strong nationalist feeling, but also the willingness of the British government to turn the methods of 1857 against the natives themselves in order to hold them in line with imperial policy. The chief reason for the British tenacity in maintaining control of India is the great economic advantages from this possession. Great Britain has a nearly complete monopoly of the vast Indian trade. Fine cloth, metal and ivory work, rice, wheat, cotton and some valuable minerals are exported from India; while Great Britain sells to India annually about $400,000,000 worth of commodities, chiefly cotton goods and iron and steel products. The British administration has brought to India the same material advantages that have accrued to Egypt under British domination in the way of irrigation and other engineering feats and the introduction of modern agricultural and industrial methods and sanitary science. See GREAT BRITAIN — FOREIGN POLICY IN INDIA; INDIA.

4. *Modern Imperialism in the Far East — The Western Intrusion in China.*— Of all the developments in modern imperialism that which will probably possess the greatest significance for the future of world history is the establishment of contact between western civilization and the Chinese Empire. The authentic history of China goes back to some 2,500 years B.C., but the dynasty which alone has any significance for the modern history of China dates from 1644, when, after a war of some 27 years, the Tatar Manchus from the north overthrew the native Ming dynasty and established the foreign domination which lasted until the resignation of the youthful emperor, Pu-yi, in 1912. In a geographic and administrative sense China is divided into southeastern China or China proper, and a number of outlying dependencies of great extent and widely varied degree of population. China proper is the only part of China that has any great historic significance and is the centre of the Chinese population and historic culture. It is about 1,500,000 square miles in area, possesses a population of something over 300,000,000, and is divided into 18 provinces or administrative districts. Surrounding China proper at the opening of the 19th century were the following more or less loosely attached dependencies, Korea, Manchuria, Mongolia, Sungaria, Turkestan, Tibet, Burma and Indo-China. Though Marco Polo had visited China in the 13th century and had been followed

in the succeeding centuries by Catholic missionaries and by Portuguese, Dutch and British traders, China remained practically sealed against European contact, except for some strictly limited commercial relations with a few ports, especially Canton. The first notable incursion of Europeans followed the deplorable Opium War of 1840–42, through which Great Britain, in the Treaty of Nanking, forced China to open four additional important Chinese ports to European trade. The foreign ingression was continued by the War of 1856–60, waged by the English and French against the Chinese and which terminated in the Treaty of Tientsin of 1860, opening six more Chinese ports to foreign trade and guaranteeing the position and safety of foreign traders and missionaries in China. Between 1853 and 1864 Great Britain aided the Manchus in putting down a native patriotic insurrection — the Tai-Ping Rebellion — because she believed the dynastic party likely to be most favorable to the foreign incursion. Further progress was made following the Chino-Japanese War of 1894–95, when the European powers abstracted from Japan most of her territorial gains. Germany followed the lead of Great Britain and France by seizing the port of Kiao-chau in the province of Shantung in 1898 as revenge for the murder of two German Catholic missionaries, whom the kaiser suddenly beheld as his "dear brothers in Christ," in spite of his well-known anti-Catholic prejudices at home. Finally, by the joint European and American armed intervention of 1900 to suppress the Boxer revolt all barriers to western commerce and economic penetration were removed and China was put under the commercial, and to a considerable extent the fiscal, tutelage of the western powers, being unable even to determine her own tariff schedules. At the same time that the western powers were forcing a commercial and financial entry into China they were also proceeding to encroach upon the Chinese dependencies and to wrest many of these from the empire. Japan took over the Liukiu Islands in 1874, Formosa in 1895, the Liaotung Peninsula and Port Arthur in 1905, Korea in 1910, and made considerable progress soon afterward in the penetration of Manchuria. Russia, taking a portion of Chinese Turkestan in 1881, pushed southward from Siberia, taking over Amur in 1860, and outer Mongolia in 1913 after having lost her control of Manchuria and the Liaotung Peninsula through the Russo-Japanese War of 1904–05. The British assumed control of Tibet between 1904 and 1914, after having conquered Burma in 1885. France occupied eastern Indo-China between 1862 and 1885. Finally, some of the most valuable Chinese ports, such as Hongkong, Port Arthur, Kiao-chau, Weihaiwei and Kwangchow Wan were handed over to foreign powers under military pressure.

The combination of foreign commercial penetration and exploitation and the accompanying territorial aggression with the humiliating defeat of China by Europeanized Japan in the war of 1894–95 led the more thoughtful and progressive Chinese leaders to feel that the old order in China must be altered to allow the entry of the more advanced military and technological methods of western civilization if China was to be saved from ultimate partition. In 1898, accordingly, the reform party, led by the young emperor, Kwang Hsu, introduced a sweeping set of political, economic and educational reforms, but their beneficent program was halted for the time being, after only about 100 days of the new régime, through a reactionary *coup d' état* led by the dowager empress, Tzu Hsi. The success of the reactionaries in 1898 led them to undertake a more ambitious program, namely, the ousting of all foreigners from China. This movement was led by the Boxers, or the "Society of the Fists of Righteous Harmony." It was stimulated by the foreign aggression; the commercial and financial exploitation; the territorial seizures; the burden of unjust indemnities; the indiscretion of the missionaries in seeking high Chinese rank, in protecting the lawless elements under the cover of a "rice conversion," and in a bigoted interference with Chinese customs; and the loose talk of foreigners about the ultimate partition of China. This anti-foreign movement broke out in 1900, but was speedily put down by Allied military intervention. On the whole, however, it would seem that the Boxer revolt probably helped along the reform tendency by proving once more the utter helplessness of China with her antiquated technique when she was confronted with the material culture of the West. In 1905 the old competitive state examinations were abolished and the basis laid for a new compulsory public school system. In 1906 legislation was enacted looking forward to the extinction of the opium trade. In 1911 occurred the great Chinese Revolution. It broke out on 12 October, and received special support from the southern provinces. In about three months the revolution had accomplished its aims, and in February 1912 the Manchu dynasty was ended and a republic proclaimed. To give greater unity and strength to the new republic the revolutionary president, Dr Sun Yat Sen, with a high degree of patriotic self-restraint, retired from power and surrendered the presidency to the northern and more conservative statesman, Yuan Shih Kai, a disciple of Li Hung Chang and next to his master the most astute of modern Chinese statesmen. The subsequent history of reform in China has centred around the struggle between the north and south of China. The northerners, led by Yuan Shih Kai, have desired to set up a constitutional monarchy, while the more radical southern party, led by Dr. Sun Yat Sen, have preferred a progressive republic. The southern party organized a revolt in 1913 against the conservative policies and the provisional constitution of 1913, but this was speedily suppressed and conservatism was only strengthened. Encouraged by his successes, Yuan Shih Kai plotted a restoration of the empire in 1915. By carefully manipulating the press and telegraph lines Yuan made it appear that there was an overwhelming desire in China for him to restore the empire and assume the imperial title. He announced his intention "to bow before the mandate of the people" on 11 Dec. 1915, but 12 days later the radical counter-revolution broke out which soon defeated Yuan and supplanted him, after his death in June 1916, by the vice-president, Li Yuan Hung. A final effort to restore the empire came in July 1917 when Gen. Chang Hsun attempted to put the baby emperor, Hsuan Tung, on the throne, but this

reactionary *coup* was crushed in seven days. Li Yuan Hung, refusing to resume office as president, was succeeded by Feng Kwo Chang in July 1917, and in October 1918, Hsu Shih Chang, a northern military leader, was elected president. A civil war between northern and southern China, alleged to have been fomented in part by Japanese intrigue, has been in progress since 1917 with varied intensity and unsuccessful attempts at final adjustment, but it seems likely that the common indignation of the Chinese at the treatment of China by the Peace Conference will go a long way toward healing the breach between the two districts. It appears absolutely certain that China will be successful in establishing a liberal form of government and will go through a vast economic transformation within the next half century. The great natural resources of China warrant the prediction that she is bound to become one of the first industrial states of the world as soon as she is enabled to exploit these resources by more advanced methods. What she needs above all other things is ample public revenue to finance the reform program. The World War was a severe blow to China in this respect, as it prevented the final arrangement of a large international loan to her which was contemplated on the eve of the war. Steps are already being taken, however, by the Western powers to arrange for a great post-war loan to China. See CHINA — HISTORY.

The Awakening of Japan.— European contact with Japan was first established in the middle of the 16th century and at first the Japanese welcomed the foreign incursion, but fearing European domination they ousted the foreign element in the decade following 1587, and massacred many of the Christianized natives. From 1600 to 1853 European relations with Japan were limited to a very severely restricted trading arrangement with the Dutch. In 1853–54 Commodore Perry, an American naval officer, obtained certain commercial concessions for American ships, and his success prompted other nations to attempt to secure similar privileges. Native opposition soon developed. The *Daimios* or feudal princes opposed the policy of the *Shogun* in opening Japan to foreign interests and began an active anti-foreign campaign. As a mode of retaliation for this attitude the American and European fleets bombarded the Japanese ports of Kagoshima and Shimonoseki in 1863 and 1864. This action proved a very successful and rapid demonstration of the superiority of Occidental material culture, and the daimios, like the Chinese in 1900, readily perceived the necessity of adopting the Western technology as a protective measure if they desired to preserve the independent existence of Japan. From 1867 to 1871 a political revolution occurred which ended the shogunate, revived the imperial power, abolished feudalism, carried through sweeping legal and administrative reforms, and established a new national army drilled and equipped according to Western standards. These reforms were systematized in a new constitution drawn up and accepted in 1889. A patriotic national religion was secured through the revival and strengthening of Shintoism, and a deliberate and systematic introduction of the European and American industrial technology was provided. As a result Japan has advanced in less than a half-century from a feudal régime with an archaic industrial and military technique to a modern industrial nation and a first-class military state. But, as in the case of modern Germany, the rapid technological evolution of Japan has not allowed the operation of the broader cultural forces which should accompany and moderate so sweeping a technological change, and the Japanese cultural complex has retained a large number of anachronisms which help to make Japan under the present dominating classes a dangerous and aggressive state. The growth of capitalism, as elsewhere, has produced a tendency toward imperialism and territorial expansion, which in the case of Japan has been greatly hastened and intensified by the dynamic power of a fanatically patriotic religion. In this process of imperialistic expansion it was natural that Japan should turn to the adjoining islands and to the neighboring coast of eastern Asia. The Liukiu Islands were secured from China in 1874; Formosa was retained from the spoil of the Chino-Japanese War of 1894–95; as a result of the Russo-Japanese War of 1904–05 the Liaotung Peninsula and Port Arthur, as well as southern Sakhalin, were obtained, and Korea and Manchuria were freed from Russian domination; in 1910 Korea was annexed and a political and economic penetration of Manchuria begun; as a result of minor and ineffective participation in the World War, Japan was awarded the German possessions in the Shantung Peninsula, with some political reservations, and the German island possessions in the Pacific north of the equator, including the Caroline, Pelew, Marianne and Marshall islands. During the war period the notorious "21 (later 24) demands" of Japan upon China were successfully negotiated and forced by Japan from 18 Jan. to 9 May 1915, and also the deplorable Lansing-Ishii Agreement of 2 Nov. 1917, by which the United States, while formally proclaiming that it recognized and continued the policy of an "Open Door" for China, actually gave up that position and conceded to Japan special interests in China and contiguous Asiatic territory, thereby confirming in practice Japan's claim to a Japanese Monroe Doctrine for China if not for the entire Far East. The "21 demands" are worthy of at least a brief summary and classification. They were divided into some five general groups. Group one required the cession to Japan of the former German interests in the Shantung Peninsula, with some significant extensions of the German concessions. Group two called for a recognition of the special position of Japan in southern Manchuria and Inner Mongolia, with respect to economic and political influence and activity. Group three aimed to give Japan control over the Chinese Hanyehping Company, in other words, over the key to the iron and steel industry and the coal mines of China, with power also to exclude other nations from threatening Japanese domination. Group four was designed to give Japan power to dominate future concessions of Chinese territory by requiring China "not to cede or lease to any third power any harbor or bay or island along the Chinese coast." Most significant of all was the fifth group, according to which "China was to employ Japanese

advisers in political, financial and military affairs; to admit Japanese to joint participation in the policing of 'important places'; to purchase from Japan 'say fifty per cent. or more' of her munitions of war, or allow the establishing of an arsenal in China under Japanese supervision; to grant Japan the right to construct important designated railway lines in the Yangtse Valley; to specify that Japanese might carry on missionary propaganda and own lands for hospitals, churches and schools in the interior; and to give Japan first option for the furnishing of capital for developments, 'including dock yards,' in the Fukien Province." It will readily be seen that these practically abrogated the sovereignty of China in both foreign relations and domestic affairs, and that as long as they are recognized they must inevitably prove a stumbling block to all liberal foreign relations in the Far East. As a result of the war Japan has also advanced to a position of first-rate importance in the world's shipping. While there is little doubt that Japan is likely to prove the most aggressive and intractable modern state in imperialistic expansion, there can be no question that the western nations must refrain from a "holier than thou" attitude in the premises, for Japan received her first lessons in *Weltpolitik* and *Machtpolitik* from the nations of Europe, from the time of the bombardments of 1863–64 to the despoiling of Japan by the European powers after the Chino-Japanese War of 1894–95. Nor has the conduct of the European powers in world politics generally been of the sort to convince Japan that they were all inspired by the golden rule, any more than their redistribution of German colonial possessions, and commercial interests in Africa and western Asia would be likely to make Japan hesitant in demanding the German possessions in the Far East. Probably the most promising aspect of the Japanese question in *Weltpolitik* is the existence of a growing liberal party in Japan which is likely to come into power and to repudiate the aggressive policy now being pursued. See JAPAN — HISTORY, 1889–1919; JAPAN — RUSSO-JAPANESE WAR.

The Philippine Islands and American Interests in the Far East.— The occupation of the Philippine Islands by the United States was but an incident in the beginnings of the overseas expansion of this most powerful of American republics. Mr. Bryan and others were greatly stirred in 1898 by what they regarded as a new and doubtful venture in American policy, but in reality the conquest of the Philippines was a new policy only in the matter of geographic location and not from the standpoint of a social or political process. If by imperialism is meant the occupation and exploitation of virgin soil previously possessed by a more primitive people, no nation has been more persistently imperialistic than the United States. Like Russia, the United States was long able to expand through the seizure of contiguous territory, and the history of the United States since 1789 can only be properly comprehended when interpreted as a process of continuous westward expansion. The 19th century witnessed the occupation of the central portion of the American continent from ocean to ocean, but the passing of the frontier in 1890 produced the necessity of discovering a field for expansion and investment elsewhere than within the boundaries of the United States. The dispute with Spain over Cuba proved but a welcome pretext and a moral issue which allowed the formal and systematic initiation of a process which had been long in preparation. While the West Indies and the region of Central America and Mexico have been far more important in the commercial phases of the imperialism of the United States than the Philippine Islands, the latter constitute the best example of a systematic attempt at colonial administration by the United States.

The original population of the Philippines was probably a primitive pygmy negro stock, to which were added by migration Malayans, Chinese and Arabs. The Philippines were first discovered by Europeans in 1521 when Magellan's fleet reached this region. The actual conquest by the Spanish was carried on from 1565 to 1571 under the leadership of Miguel Lopez de Legazpi. The conquest was most superficial, Luzon being the only island which was subjected to any considerable degree. From this time until 1898 the Philippines were controlled by Spain, save only for the period of 1762–63, when Manila was occupied by the British. They were governed as a subdivision of the larger administrative unit of Mexico. The condition of the Philippines under Spanish rule was one of almost unrelieved stagnation and corruption. The political administration was generally corrupt and extravagant and the occasional honest and competent administrator met a fatal opposition from the "vested interests." The economic and commercial life of the islands was paralyzed under the restrictions imposed by the severe mercantilistic policy of the mother country. Finally, the Catholic friars secured control of much of the best land, especially in Luzon, intimidated the civil government, and secured much immunity from the civil law. So onerous did the clerical domination become that several reform movements developed, the last of which had proved successful on the eve of the American occupation. The military events connected with the American conquest of the Philippines are well known. Dewey crushed the Spanish opposition on the sea by his brilliant victory of 1 May 1898, and the land forces of the Spanish were soon overpowered by General Merritt. By the treaty of 10 Dec. 1898, Spain agreed to cede the Philippine Islands to the United States in lieu of a payment of $20,000,000 and the guaranty of free entry of Spanish ships into Philippine ports for a period of 10 years. In spite of violent opposition from the "anti-imperialists," the United States government decided to accept the responsibility for "civilizing" the inhabitants of the new island possessions. A preliminary Philippine Commission, headed by President Schurman of Cornell University, went to the Philippines in 1899 and gathered information essential to the establishment of a civil government. A more permanent administrative commission with Judge W. H. Taft at its head was sent to the Philippines in 1900. Before his retirement three years later Mr. Taft had by his constructive administrative ability won that admiration by President Roosevelt which later secured for him the presidency of the United States. A civil government was

established in July 1901, with the commissioners at its head. Native Filipino members were later added to the commission. The notable Philippine Act of 1 July 1902, made the civil government permanent and provided the governmental arrangement which, with some modifications, prevailed down to the Jones Act of 1916. Pursuant to the policy of the act of 1902 a census was completed in 1905, and an election held for a native assembly in 1907. From 1907 to 1916 the commission acted as the upper house of the legislature, though after 1913 more Filipinos were added to the commission. In August 1916, the Jones Act which provides the present constitutional basis of the Philippine government, ordered the establishment of a native senate as well as a native house of representatives. The chief executive remains the governor-general appointed by the President of the United States. The judiciary was established in 1901, and has from the beginning been made up of a majority of Filipinos. The Democratic administration has been especially favorable to an early acquiescence in granting the Filipino request for complete independence, but even a Democratic Congress could not be induced in 1916 to commit itself to any definite date at which independence might be expected. It is extremely doubtful if complete autonomy will be granted as long as there is urgent need for checkmating Japanese aggression in the Orient, for the United States could not afford to retire from so advantageous a position or risk the possibility of being superseded by Japan as the possessor of the Philippines. While there is a warm sentiment for independence in the native population, there can be no doubt that the American administration has in 20 years accomplished great results in the way of improving the material culture of the Filipinos, in fact here rivaling the achievements of the British in Egypt. The oppression and corruption were speedily wiped out; sanitary conditions have been greatly improved; the currency has been standardized; great public works have been completed; means of communication and transportation have been improved and widely extended, railroads having been introduced; the educational work with the natives has been one of the most creditable of the administrative achievements, school facilities having been extended to over half of the population; industry and commerce have been fostered and greatly increased; and, finally, the juridical and penal institutions have been revolutionized, the Bilibid prison at Manila and the Iwahig penal colony on the island of Palawan constituting probably the most advanced and successful penal system now in existence anywhere. The products of the Philippines are principally agricultural, being in order of importance, corn, rice, manila hemp, cocoanuts, sugar and tobacco. The rice and corn are, however, raised almost entirely for home consumption. Little manufacturing industry exists, though there has been a considerable development of sawmills and cocoanut-oil factories. At the present time the commerce of the islands is controlled by the United States which ships to the Philippines more goods than all other countries combined and buys from the Philippines about twice as much as all other countries. While this domination has been abnormally increased by war conditions, it seems that the United States has arrived at a state of effective preponderance in Philippine commercial relations and that in this case, at least, "trade has followed the flag." It is further probable that there is nothing subtle in the assertion that this state of affairs is not at all conducive to the hastening of the relaxation of the political grip of the United States on the Philippines. See PHILIPPINE ISLANDS.

Oceania and Australasia.— One of the areas of so-called backward races which has been most thoroughly appropriated by western imperialistic nations is that which includes the islands, greatly varying in size and importance, which are situated south and east of Asia. These are usually divided into two major divisions, Oceania and Australasia. The former is further subdivided into Malaysia, Polynesia, Micronesia and Melanesia, while the latter is composed of Australia, Tasmania, New Zealand and the lesser adjacent islands. Malaysia, sometimes known as the East Indies or the Malay Archipelago, is made up of the islands lying immediately to the southeast of Asia, the most important of which are Sumatra, Java, Borneo, Celebes, New Guinea, and Luzon and Mindanao of the Philippine group. The great majority of these belong to the Dutch, the only exceptions being the Philippines; eastern Timor, belonging to Portugal; the British possessions of Singapore and parts of Borneo and New Guinea; and the former German colony in northeastern New Guinea, known as Kaiser Wilhelmsland. Polynesia comprises the great majority of the islands of the western and mid-Pacific area, including the Fanning, Ellice, Tokelau, Tonga, Kermadec and Cook islands, belonging to Great Britain; the Samoan Islands formerly belonging, with the exception of an American naval base, to Germany; the Austral, Society, Tuamotu and Marquesas islands possessed by France; and the Hawaiian Islands, a territory of the United States. Micronesia consists of the Marianne, Pelew, Caroline and Marshall islands, formerly owned by Germany; and the Gilbert Islands possessed by Great Britain. Melanesia comprises the Santa Cruz, Banks, Fiji, D'Entrecasteaux and Louisiade islands, belonging to Great Britain; the former German colonies of the Admiralty, Bougainville and Bismarck islands of the Bismarck Archipelago; the Solomon Islands, owned formerly by Great Britain and Germany; the French possessions of New Caledonia and the Loyalty Islands; and the New Hebrides owned jointly by France and Great Britain. The economic resources of the region known as Oceania vary greatly. The Dutch possessions in Malaysia have throughout modern times been the chief source of the world's supply of spices, and are also important for production of tea, coffee and tropical fruits and woods. The products of the Philippines have already been mentioned. The lesser islands in some cases possess valuable mineral deposits and most of them produce the cocoanut and tropical fruits in a varying degree of profusion, but, with few exceptions, the western powers have sought dominion in these oceanic regions on account of the supposed strategic value of harbors,

naval bases and coaling stations in the Pacific area. As yet the economic exploitation of much of the district has not been systematically prosecuted. While the international relations in this area have been rich in producing significant developments in diplomatic negotiations, there have been only a few incidents worthy of specific mention. The Philippine situation has already been treated. Next to these islands the most important international controversy in Oceania arose over the Samoan Islands. From 1877 to 1889 Great Britain, Germany and the United States contested in diplomacy for these islands and an international war would probably have been precipitated over them had it not been for the hurricane of 16 March 1889, which destroyed the fleets of the rivals in these waters. Matters were smoothed over, and by the agreement of 2 Dec. 1899, most of the Samoan Islands were handed over to Germany, with the exception of Tutuila and some lesser islands taken by the United States. In the World War the German Samoan possessions were captured by New Zealand and given to this state by the Peace Treaty of 1919. The Hawaiian Islands, annexed by the United States in 1898, after a considerable debate, constituted the first important Pacific extension of American imperialism. The chief significance of the World War in this area was its relation to the disposition of the German possessions in Oceania. In general, the German islands north of the equator were handed over as mandatories of Japan, while those south of the equator, with the exception of Samoa, were given to Australia. This region can never possess any great importance for the future commerce of the world, except in the case of scattered deposits of rare minerals and through providing coaling stations and dry-docks, but, as the Samoan incident proved, trifling disputes over such insignificant islands may jeopardize the peace of the world. The chief cause for apprehension at present is the possibility of an attempt of Japan to assert her right to a hegemony of Oceania, especially if her progress in China and Siberia should be blocked. See MELANESIA; OCEANICA.

Australia, while discovered by Portuguese and Dutch navigators early in the 17th century, was not extensively explored or claimed as a European possession until 1770, when Capt. James Cook sailed along a considerable portion of the coast and established the claim of Great Britain to this great continent. A use for the region was found after the American Revolution had prevented Great Britain from making the American colonies a dumping-ground for the great number of criminals produced by her barbarously severe criminal laws. In January of 1788 the settlement of Australia was begun by the landing of nearly 1,000 criminals at Botany Bay. The Australian penal colony was of great importance in the history of penology, as it was here in 1840 that Alexander Maconochie began his reforms which developed into the Irish system of penal administration under Walter Crofton and the Elmira Reformatory principle under Z. R. Brockway and others. In 1803 the settlement of Tasmania began and the resources of Australia were discovered by such explorers as Sturt, Hume, Stuart and others. The explorations revealed the possibility of an economic exploitation of Australia. Sheep were introduced in the first quarter of the 19th century from South Africa and Spain, and today Australia is much the most important area for the production of export wool in the world. Gold was discovered in 1823 and 1851, and a large immigration of gold-seekers followed. Finally, the adaptability of Australia to wheat raising attracted a large number of farmers. Those who came to Australia for economic reasons naturally opposed the further population of the region by convicts, and their protests, together with the reform of the English criminal jurisprudence, led to the discouragement of criminal transportation after 1840 and to the complete termination of the practice after 1857. By 1859 some six colonies had developed in Australia and Tasmania, New South Wales, Victoria, Queensland, South Australia, North Australia and Tasmania. In 1852 Great Britain permitted the Australian states to hold constitutional conventions and determine their own form of government, but the problem of the method of federal and imperial union was not settled until a half-century later. As early as 1847 it had been proposed by British statesmen that Australia have a general legislative body, but particularism, especially in regard to the tariff, prevented such a project from being immediately executed. From this time onward there were sporadic attempts to secure unity. Intercolonial conferences and conventions, at which the importance of unity was stressed, were held in 1867 at Melbourne, in 1880 at Melbourne, in 1883 at Sydney, in 1890 at Melbourne, in 1891 at Sydney, and in 1897–99 at Adelaide, Sydney and Melbourne. The conventions of 1897–99 drafted a constitution for Australia and Tasmania which was embodied in the Australian Commonwealth Act of 1900, uniting the six colonies into a self-governing unit within the British Empire to be administered under a form of government supposed to combine the best aspects of the governments of England and the United States. New Zealand, though included in Australasia, is situated no less than 1,200 miles from eastern Australia. It was discovered by the Dutch in 1642, and the coast was explored by Captain Cook in 1769. From this time until 1839 it was nominally claimed by Great Britain, but was not settled. In 1839 Great Britain formally assumed possession of the region. In 1853 New Zealand was given self-government, and in 1865 it was separated in an administrative sense from Australia. In 1876 the evils of particularism were remedied by an abolition of the local provincial councils and the establishment of a more unified system. In September 1907, it was proclaimed the "Dominion of New Zealand" and transformed into another self-governing colony of the British Empire. In both divisions of Australasia advanced programs of radical democracy and social legislation have been successfully adopted, and these self-governing units of the British Empire are entitled to rank as the most progressive of the world's democracies. New Zealand has been most conspicuous in this progressive movement. A defeat of the labor unions in a great strike in 1890 led to vigorous political activity on the part of labor, and the radical party controlled New Zealand for

nearly a quarter of a century. It proceeded to enact laws providing for woman suffrage, proportional representation and the referendum, compulsory arbitration of labor disputes, government ownership of railroads and other public service utilities, progressive land taxation, old age pensions, workingmen's compensation and other types of modern advanced social legislation. While Australia has not gone quite as far in this direction as New Zealand, she has adopted most of these advanced measures of a progressive democracy, especially since the growth of the strength of the Labor Party in the 20th century. The chief industries of Australasia are the raising of sheep, horses and cattle, hardwood timber extraction, wheat cultivation, and gold mining. Manufacturing industry is now developing and the great supply of raw wool and the existence of rich coal and iron deposits make it certain that in the future Australia will assume a leading position among the manufacturing states of the world. The commerce of Australasia, which in 1916 amounted to over a billion dollars, is still over 60 per cent with Great Britain and parts of the British Empire, though in recent years there has developed an ever greater tendency to trade more and more with foreign countries. Following the lead of Canada, Australia and New Zealand have adopted the principle of imperial preference and have reduced their duties on British products brought into Australasia. Provisions for home and imperial defense have been made, Australia having adopted compulsory military service in 1909 and New Zealand in 1910, while in 1909 Australia began the construction of her very respectable navy which played an important part in the World War by clearing the Pacific of German raiders. The soldiers of Australia and New Zealand participated with distinction in the war, both in the disastrous Gallipoli expedition and on the Western Front. They also conquered the German colonies in the southern Pacific. At the Peace Conference the Australasian delegates took an aggressive part, demanding the conquered German colonies south of the equator, opposing Japanese occupation of those north, constituting the most effective obstacle to Japan's attempt to secure the recognition of racial equality in immigration laws, and indicating a determination to establish an Australasian "Monroe Doctrine" for the southern Pacific. The vast extent and great natural resources of Australasia justify the opinion that it is likely to prove the seat of one of the most important and most advanced civilizations and one of the strongest political organizations of the future. See AUSTRALIA — DISCOVERY AND EARLY HISTORY; NEW ZEALAND.

Summary Generalizations Concerning International Relations in the Far East.— It may be useful at this point to summarize the present status of international relations in the Far East. Great Britain can be relied upon to attempt to maintain control over Tibet in order to protect India, and to stand back of Australasia in most policies designed to strengthen the British Empire in the Pacific. France is likely to evince a lively interest in all negotiations affecting southern China, but if she gains a free hand in Syria her imperialistic efforts are likely to be centred in the main on Africa and western Asia. The fate of western Siberia apparently hangs on the future of the Russian Empire. If the latter disintegrates into chaos, Japan is likely to dominate the greater part of eastern Siberia, but if a strong Russia emerges it is probable that she will retain her grip on Siberia. The future disposition of Manchuria and Mongolia is also most uncertain. At present Japan dominates Manchuria and inner Mongolia, while Russia still formally preserves her loose control over outer Mongolia. A strong and unified China may oust both Russia and Japan, but it seems more probable that a weak Russia and China will for a time be dominated by an aggressive Japan in this region. Korea is completely controlled by Japan, but the significant development of the patriotic nationalist movement in Korea within the last year makes it certain that Japan will have difficulty in maintaining an iron grip on Korea. How far the "Open Door," or international commercial equality policy, established in March 1900 by John Hay, still prevails in China it is difficult to say. The notorious "21 demands" made upon China by Japan in 1915 certainly compelled special concessions to Japan of a very concrete and considerable nature and they were not vigorously protested by the United States. Indeed, the United States practically acquiesced in this shameful extortion by the Lansing-Ishii Agreement of November 1917, which recognized the "special interests" of Japan in China. It has become evident that only a strong and united China will suffice to enforce international equality in the Chinese Republic. What China most needs to secure her future development is adequate funds. These were about to be provided in 1912, though not without embarrassing concessions, through an international consortium of the so-called "Six Power Loan Group"— England, France, Germany, Belgium, Japan and the United States. President Wilson's opposition caused the United States to withdraw, and the European War broke up the whole plan. A new loan consortium is now being arranged. Japan, enriched by the spoil of the German colonies in the Far East and by recent extortion in China, is now at the height of her aggressive imperialism, but is likely to meet strong opposition. China is nearly a unit against her since the Peace Conference. The interests of the United States in the Philippines and Hawaii will keep the latter country alert against Japanese domination. Great Britain, no longer fearful of Germany or Russia, is likely to desire to break away from the Anglo-Japanese agreement of 1902. A China militarized and dominated by Japan would be a serious menace to India. Great Britain will probably be strengthened in this attitude by the unmistakable anti-Japanese sentiment in Australasia. With the growth of population and wealth in the last-named region a new element is entering the politics of the Far East, and the European and American expansionists seem likely to have to deal with a contender of the same race in the eastern hemisphere. In the main, however, it seems highly probable that the core of the international relations of the Far East during the next half century will be the developments within China. See CHINA—DIPLOMATIC

RELATIONS WITH; JAPAN — DIPLOMATIC RELATIONS WITH; RUSSIA AND THE WAR.

5. *Latin America in Modern Imperialism.*— On account of its original settlement by Spanish, Portuguese and French, the American continent and adjacent islands from the southern boundary of the United States to Cape Horn are conventionally known as "Latin America." The matter of the original settlement has been briefly alluded to in an earlier section of this article. It will be sufficient at this place to recall that this region was explored and settled mainly by the Spanish, with the exception of Portuguese Brazil and a few French settlements in the West Indies. Politically Spanish America was controlled through a highly centralized administrative system culminating in the Royal and Supreme Council of the Indies, established in 1542. In an economic sense the trade of the Spanish colonies was regulated under the provisions of the extremely rigid Spanish mercantilism administered through the so-called "House of Trade," which was created in 1503 and extended and systematized during the next half century. Dwelling under a corrupt and inefficient officialdom and a stifled commercial activity the inhabitants of Latin America made little general social and political progress until the era of the revolutions following 1810. The series of revolutions in the Latin-American states were closely related in their origin to contemporary events in European history. In 1808 Napoleon had invaded Spain and aroused the patriots and liberals to resistance. In 1812 they drew up a liberal constitution, modeled after the French constitution of 1791, and the wave of liberalism extended to the Spanish-American colonies in the western hemisphere. After the overthrow of Napoleon in 1814 the reactionary régime under the unspeakable Ferdinand VII was restored in Spain and an attempt was made to revive it in the colonies, but the latter resisted. Spain, unaided, proved unequal to the task, but in the year 1823 the reactionary powers, joined together by the Quadruple Alliance of 20 Nov. 1815 and dominated by the sinister spirit of Metternich, determined to aid Spain in American intervention against revolution. At this juncture Great Britain took a vigorous stand in opposition. She had welcomed the overthrow of the old Spanish trading restrictions after 1812 and had built up a lucrative and flourishing trade with the Spanish colonies. This trade she feared she would lose in the event of the restoration of the Spanish domination. Therefore, on 23 Aug. 1823, George Canning, the English foreign secretary, suggested to Richard Rush, the American ambassador in London, that the United States join with Great Britain in a note to the group of reactionary powers warning them against intervention in Latin America. While Rush was communicating with Washington Canning informed Polignac, the French ambassador at London, that Great Britain would oppose intervention by any country save Spain alone. Alarmed by the European situation and by Russian aggression along the Pacific Coast of North America, President Monroe and his advisers gladly accepted the suggestion of Canning in protesting against intervention. The Secretary of State, John Quincy Adams, however, convinced Monroe that the declaration should be made independent of Great Britain and be formulated what became the famous "Monroe Doctrine," when embodied in the Presidential message of 2 Dec. 1823. The chief pronouncements were the declaration of the separation and distinctness of the two hemispheres; the doctrine of non-intervention of European powers in American domestic politics; the proclamation, set forth especially for the attention of Russia, that the American continent was closed to further European colonization; and that the extension of absolutism to America would be unwelcome to the United States. Canning was pleased with the American attitude and gave notice that the British fleet would back up the policy enunciated by the United States. In this way the independence of the Latin-American states was assured and the first systematic formulation of American foreign policy definitely expressed to the world. The Anglo-American opposition to Metternichian intervention clinched the movement toward independence and Latin America soon became a group of independent American states. Haiti declared its independence in 1804, San Domingo in 1821 (1844), Cuba in 1902, Mexico in 1821, Guatemala in 1821 (1847), Salvador in 1821 (1838), Honduras in 1821 (1839), Nicaragua in 1821 (1839), Costa Rica in 1821 (1838), Panama in 1903, Colombia in 1813, Venezuela in 1811 (1829), Ecuador in 1811 (1830), Peru in 1821, Brazil in 1822, Bolivia in 1825, Paraguay in 1811, Uruguay in 1828, Argentine Republic in 1816 and Chile in 1818 (dates in parentheses refer to establishment of present independent states). As these dates will indicate, the two chief periods of national differentiation were from 1810 to 1830 and from 1838 to 1850, with two late additions at the very opening of the 20th century. Although with these independent states in Latin America there are the following foreign possessions: British Guiana, British Honduras, Jamaica, the Bahamas, the Barbados, the Leeward and Windward Islands, Trinidad and Tobago controlled by Great Britain; French Guiana, Martinique and Guadeloupe owned by France; Dutch Guiana, Curaçao and some lesser islands belonging to Holland; and Porto Rico and the Virgin Islands possessed by the United States. The development of the Latin-American nations since the establishment of their independence may be divided into three broad periods characterized by certain definite advances. That from independence to about 1852 "the age of dictators"; that from 1852 to 1876 as the era of the struggle for stability and organization; while that from 1876 to the present was one notable for general social progress and the emergence of certain leading Latin-American states. It might also be added that the period from 1898 to the present has been conspicuous for the development of international relations in this district, namely, the rise of a distinct Latin-American foreign policy under the direction of the so-called "A B C Powers" (Argentine, Brazil and Chile) which has challenged the Monroe Doctrine over Latin America generally and south of the equator in particular; the development of an opposing tendency in the aggressive imperialism of the United States in this region with a bold extension of the implications of the Monroe Doctrine for Latin America; and the attempt to

compromise these two conflicting tendencies through the development of the Pan-American movement, which has been in progress since 1889.

The expansion of the Monroe Doctrine has kept pace with Latin-American progress and the development of the foreign relations of the United States. Under Jackson the doctrine was not developed because it was associated in its origins with John Quincy Adams, all of whose works were anathema with Jackson. Polk introduced a novel and aggressive interpretation — a sort of precautionary or preventive policy — to the effect that the United States should annex all American territory which might eventually fall into European hands. This view was strengthened by Seward's warning to Napoleon III to leave Mexico in 1865 and by President Grant and Secretary Fish, who announced that no European power might annex any American territory, irrespective of whether the annexation was voluntary or forced, and proclaimed the United States the leader in American policy. In 1889 Blaine further contended that the United States would not sanction the conquest of American territory either by Latin-American states or by foreign powers. The Clayton-Bulwer Treaty of 1850 originated the half-century discussion as to the bearing of the Monroe Doctrine on the isthmian canal project. When the French company was formed in 1878–79 to build the Panama Canal Secretary Evarts and President Hayes declared that any isthmian canal must inevitably become a coast line of the United States. In 1881 Blaine warned that a European canal would be equivalent to the extension of the European political system to the American continent. Finally, in 1903 President Roosevelt allowed the United States to sanction violent changes in Latin-American governments in order to secure our dominance in the canal scheme, and the completion of the Panama Canal by the United States and our option on the Nicaragua route has settled that problem. In 1895, as a phase of the Anglo-American dispute over Venezuela, President Cleveland and Secretary Olney made a startling extension of the Monroe Doctrine when they declared it to be an accepted and integral part of American public law and that the law of the United States was sovereign on the western hemisphere in such matters as this country saw fit to act upon. President Roosevelt's administration witnessed two notable developments of the doctrine. By allowing the German fleet to bombard ports of Venezuela he refused to accept the "Drago Doctrine" and gave warning that perversely delinquent Latin-American states could not skulk behind the Monroe Doctrine, while at the same time he stood firmly against territorial aggression by Europeans. His second contribution, probably the most important positive moral and political extension of the policy, as well as the most dangerous when dishonestly or unscrupulously applied, amounted to a declaration that when any American state was unable to discharge the duties normally devolving on a civilized state or when it used force on representatives of foreign countries it was the duty of the United States to intervene to maintain order and keep the peace. Following out this policy President Roosevelt took over the financial administration of San Domingo in 1905, President Taft took similar action with regard to Nicaragua in 1912 and President Wilson did the same with Haiti in 1915. Had a Republican administration been continued after 1912 it is probable that intervention in Mexico would have come ere this. In his famous Mobile speech of 1913 President Wilson declared that the United States would never intervene in any country on this continent for territorial aggrandizement, but only to restore order and promote progress, but this cannot be taken as any guaranty of the future. The question of territorial aggrandizement will be decided by the nature of a future President's advisers and class affiliations. (See MONROE DOCTRINE, THE). The World War has produced a fundamental revolution in the Monroe Doctrine. The participation of the United States in the Algeciras Congress of 1906 proved that the initial doctrine of the isolation and distinct separation of the two hemispheres was fast giving way before the growth of world commerce and international relations. What remained of this conception after 1906 was completely destroyed by the entry of the United States into the World War. Far more significant than the military intervention in Europe were the repeated public declarations of President Wilson that the chief aim of the United States in entering the war was to transform and improve the internal political organization of the German Empire, a complete reversal of President Monroe's statement that the United States would never concern itself with or intervene in the domestic politics of Europe. The United States having destroyed the isolation policy of the western hemisphere and intervened in European politics, the vigorous reassertion of the sanctity of the Monroe Doctrine by the jingoistic senators in the United States can rest only upon two foundations, the fact that we are strong enough to maintain it and the oft-asserted contention that our leadership ensures a higher type of international morality on this continent. Of the former there is no doubt; the latter must await the test of future events.

The most important and interesting phases of international relations in Latin America are the problem of the relations of the United States to Mexico and the distinct difference between the position of the United States north of the equator and south of that line. From 1884 to 1911 Mexico was under the dictatorship of Porfirio Diaz, who has been called "one of the most able and talented administrators of modern times." His rule brought to Mexico peace and prosperity but little progress toward democracy, and when he was forced to resign in 1911 there was a natural relapse into civil war. After a season of murder and treachery Victoriano Huerta, a military leader of Indian blood, emerged as provisional President in February 1913. On account of the violence attending his rise to power President Wilson refused to recognize Huerta, but also refused to intervene, and pursued his famous policy of "watchful waiting" until the local factions would be united and organized by constitutional methods under a Mexican leader. This proved a tedious process. Huerta was

forced to resign in August 1914 and was succeeded by Venustiano Carranza, but a number of the military leaders dominated by Francesco Villa, a half-breed bandit, declared their opposition to Carranza and the civil war continued, though he succeeded in getting the upper hand in the greater part of his country. The forces of Villa conducted border raids and a considerable number of American citizens on the Texan border were killed or wounded. Early in 1916 a detachment of the regular army was sent into Mexico under General Pershing to capture Villa, but the force dispatched was inadequate and not effectively supported by Washington diplomacy, and intervention ended ingloriously. In the middle of the summer the national guard was called out to police the Mexican border, the only result being a demonstration of the ineffectiveness of the militia organization, whatever the bravery of individual guardsmen. In January 1917 the Carranza government revised the constitution and put in force the amended document in May of that year. It was a notably liberal and progressive constitution, providing, among other things, for advanced social legislation, anti-trust legislation and the confiscation of churches, schools and hospitals belonging to religious associations. A new tax schedule was created for foreign oil and mining interests and Article 27 of the new constitution looked forward to the nationalizing of the natural resources of Mexico. These liberal measures aroused against Carranza all the vested interests at home and abroad. Capitalists at home were alarmed at the industrial legislation. The reactionary religious bodies opposed the liberal religious policy of the government. Above all, the foreign mining and oil interests, especially in the United States, were rendered hysterical by the new restrictions placed upon them and the plans for a future confiscation of their holdings. As soon as it began to appear that the Carranza government would remain in command of the Mexican situation and put its program into effect the foreign investors began a systematic propaganda urging every conceivable cause for the intervention of the United States in Mexico. At the close of the year 1919 the situation seemed to justify the belief that they were likely to be successful in bringing intervention to pass. Whatever the advantages of such action might be to investors in Mexico it could not but be disastrous for the country which is to-day nearer to some prospect of developing a stable democracy than ever before in its history. See MEXICO (Vol. XVIII, pp. 757-758; 793-800).

The commercial, and for practical purposes, the political domination of the United States over the Caribbean region and Central America appears to be assured. This proceeds from the lack of internal stability in this region, requiring, according to the Roosevelt interpretation of the Monroe Doctrine, the intervention of the United States to preserve order; the great increase of the trade of the United States with this area, now exceeding that of the rest of the world combined; and the necessity of naval domination to afford proper protection for the Panama Canal. In line with the establishment of this dominating position the United States has retained control of Porto Rico, exercises a general supervision over Cuba, administers the finances of Haiti, San Domingo and Nicaragua, has purchased the Virgin Islands from Denmark, has intervened in several Central American states and in Venezuela in the interest of promoting political stability and peace, and connived at the disruption of Colombia in order to secure the Panama route for the isthmian canal. While the Monroe Doctrine is formally held to apply to all of Latin America it ends in practice with the equator. There are two chief reasons for this. The first is that in this region European commercial and financial interests dominate as completely as do those of the United States north of this line; therefore, the United States has less practical reason for desiring to control the foreign policy of this region. In the second place, the A B C powers have rightfully claimed the authority for determining the general policies of the area south of the equator and resent the intrusion of the United States. In this attitude they have not been without European support and encouragement. These great powers south of the equator, supported by the more liberal element in the United States, have favored the supplanting of the Monroe Doctrine by a broader policy of Pan-Americanism. General Pan-American congresses have met in 1889, 1901, 1906 and 1910, while special scientific and commercial congresses have assembled from time to time. There is an official organization of the 21 American republics in the Pan-American Union, established in 1910 and maintained at Washington with an endowment from Andrew Carnegie. The two chief obstacles to the development of Pan-Americanism are the commercial value of the Monroe Doctrine to American capitalists and the disproportionate strength of the United States as compared to the most powerful Latin-American states. To these might be added the differences in culture, the peculiar Latin-American psychology, the domineering attitude of the United States and the inflated pride of the lesser Latin-American states that leads them to demand political equality with Argentina, Brazil and the United States in any binding legal organization of American states. The final outcome of the conflict between Pan-Americanism and the Monroe Doctrine cannot be foreseen, but it is safe to predict that the A B C powers will check the Monroe Doctrine at the equator. The significance and status of the whole Latin-American problem will probably be greatly altered by the present introduction of the modern industrial technology into South America which will tend to make this region become a very important centre of the world's industry, politics and culture. While the United States dominates Latin America north of the equator in all matters pertaining to capital, industry and commerce, a similar control is exerted south of the equator by Great Britain, Germany and France in the order given. The World War was a hard blow to German interests in South America, but they will probably revive and those of Great Britain and France seem likely to expand. See LATIN AMERICA — PAN-AMERICAN UNION; CARIBBEAN SEA; PANAMA.

6. *The British Empire in Recent World Politics.* — The more significant aspects of British

imperial history in the era of the old colonial movement, including the origins of British colonization, the struggle with the French for the colonial and commercial hegemony of North America and India, the transformation of British imperial policy in 1763 and its subsequent modification after the revolt of the American colonies and the theoretical attack upon Mercantilism by the Physiocrats, Adam Smith and others, have been briefly sketched in an earlier section of this article. It remains to trace the chief developments in the 19th and 20th centuries. From 1820 down to about 1870 the most advanced view taken toward the future of the British Empire was that of the so-called "Little Englanders," led by Cobden, Bright, Gladstone and other adherents to the doctrines of the Manchester school. They held that the colonies were both an economic burden and a political danger to the mother-country. They believed that the colonies were destined ultimately to become independent and maintained that it was much better that this process should be voluntary and unopposed than that it should be accomplished by violence and accompanied by hatred, as in the case of the separation of the American colonies. They further contended that, in keeping with the free-trade tenets and the "cosmopolitan dream" of the Manchester school, the colonies would be as valuable to the mother-country when independent as they were while an integral part of the empire. Had this group dominated British policy with a free hand it is probable that the disintegration of the imperial domains would have been accomplished before 1870. But there were other forces and other groups of colonial theorists that proved too powerful for the "Little Englanders." There was a tremendous expansion of British trade after the Industrial Revolution which brought Great Britain into contact with all parts of the world and produced a new need for the extension of markets. The prevalence of misery in the industrial population at the same time, coupled with the unprecedented increase of the native population, gave rise to a remarkable movement of emigration from England. Then, there were political impulses which kept alive the expansionist policy by promoting a sort of precautionary or protective expansion. An example of this influence may be detected in the occupation of northern India as a method of checkmating Russian extension southward. Accompanying these forces making for expansion and partially produced by them were definite theories and plans for colonization and a better organization of the imperial system which either were diametrically opposed to the doctrines of the Manchester school or profoundly modified these extreme views. At the opposite pole from the Cobdenites were of course the lineal descendants of the "King's Friends" of the days of George III, Tories and firm adherents to militarism, naval supremacy and vigorous and forcible imperial expansion. Between these two groups and probably more powerful than either in their effect upon British foreign policy from 1830 to 1870 were a group of constructive Liberals led by Lord John Durham, Charles Buller and Edward Gibbon Wakefield. Theirs was a socio-political theory which has been well summarized by Ramsay Muir: "The main object of colonization was the systematic draining-off of the surplus population of the older lands. This, it was felt, could not safely be left to the operation of mere chance; and one of the great advantages of colonial possessions was that they enabled the country which controlled them to deal in a scientific way with its surplus population, and to prevent the reproduction of unhealthy conditions in the new communities, which was apt to result if emigrants were allowed to drift aimlessly wheresoever chance took them, and received no guidance as to the proper modes of establishing themselves in their new homes." These men were also effective in modifying the Cobdenite view of the inevitability of the independence of the colonies by holding that self-government would give the colonists all the advantages of independence without separating them from the mother-country and destroying all unity of imperial policy. It was their influence which brought practical self-government to Canada in 1847 and formal self-government to Australia in 1852, and to New Zealand in 1853. Finally, there operated the influence of the missionary spirit, which was the logical heir of the anti-slavery crusade in the empire led by Bishop Wilberforce and which met with final success in 1833. The missionaries emphasized the moral obligation of protecting and civilizing the backward peoples and kept alive the impulse to expansion, not only in the growing English-speaking colonies, but also in the regions inhabited wholly by blacks. These forces and theories served to carry the British Empire over intact until Disraeli, who had in his early days declared the empire a mill-stone around England's neck, could purchase the Suez Canal stock in 1875 and initiate the new period of British imperialism. By the "80's" the new scramble for the remaining unappropriated parts of the earth was in full swing with Britain managing to get the "Lion's share" of the spoil, as she had in the old colonial movement. The influences which stimulated the neo-expansionist movement in Great Britain after 1870 were a continuation and intensification of those forces which checked Cobdenism and the "Little England" tendency in the middle of the century, the contagion of the general wave of colonial expansion which swept over Europe from 1870 to 1895 with the defensive measures which this forced upon England, and, finally, the renaissance of the expansionist group in British politics with the long ascendancy of the Conservative and Unionist parties after 1875. The specific results of British imperialistic activity in this period have been summarized in the description of the progress of imperialism in the various areas which have been brought under review.

The British Empire, as now constituted, embraces something over 13,000,000 square miles, about one-fourth of the land surface of the earth, with a population of about 450,000,000. Of this population, those of European descent number only about 60,000,000, of which number 45,000,000 dwell in the United Kingdom of Great Britain and Ireland. Of the remaining 15,000,000 Europeans in the overseas possessions of the empire not to exceed 13,000,000 are of English descent. The British Empire, then

is probably the most stupendous example in history of a vast territory and a great population held together and dominated by a small number of persons drawn from a politically and economically more advanced and highly organized civilization. From an administrative standpoint the British Empire as now organized falls into some six different classes of possessions, the self-governing colonies, the crown colonies, the chartered companies, the protectorates, a few residual possessions, of which India is the most important, which are hard to place within any of the preceding categories, and the new mandatories handed over to Great Britain by the Peace Conference. The self-governing colonies are constituted by the Dominion of Canada, Newfoundland, the Australian Commonwealth, the Dominion of New Zealand and the Union of South Africa, the colonies, in other words, which are chiefly inhabited by British emigrants. The administrative and constitutional history of the self-governing colonies, considered in their relation to the British Empire, centres about three progressive processes, the granting of self-government, the progress of local colonial federation and the trend toward imperial federation and tariff preference. The grants of self-government came in most cases in the middle of the 19th century, as a result of the agitation of Wakefield and his adherents. Canada received self-government in 1847, Newfoundland in 1855, Australia in 1852 and New Zealand in 1853. The principle was delayed in the Union of South Africa until 1909, for the obvious reason that the constituent parts of that colony, on account of historical and other causes, were not adapted for self-government before this date. The federation of the various units in each self-governing colony soon followed. Canada was united by the British North American Act of 1867, Australia by the Commonwealth Act of 1900, New Zealand by the Act of 1907 and South Africa by the imperial legislation of 1909. Parallel with this process has gone the effort to bring a closer union between the mother-country and the self-governing colonies, led in most cases by the most ardent imperialists in the colonies and at home. The earliest move in this direction was the series of imperial conferences which began in 1887 and have met periodically for a discussion of problems and policies which were a matter of common concern to the empire and its organization and administration. The first conference was held in London in 1887, the second in Ottawa in 1894, and subsequent ones in London in 1897, 1902, 1907 and 1911, culminating in the imperial war conference of March 1917. The conference of 1907 provided for subsequent quadrennial conferences and for the representation of the United Kingdom and the colonies through their respective premiers. The war conference of 1917 resolved upon the institution of an imperial cabinet to meet annually or more frequently if necessary; the calling of a special conference for a readjustment of the constitutional relations of the various parts of the empire; the representation of India at all future conferences; more systematic and scientifically distributed provisions for imperial defense; and such encouragement of imperial preference as would tend to stimulate imperial production and make the empire independent and self-sufficient in an economic and commercial sense. A war cabinet of imperial dimensions was, accordingly, created and the other provisions are being worked out. Paralleling the movement for imperial federation was the accompanying economic movement toward greater imperial cohesion, namely, imperial tariff preference. The leader in this movement was the colonial secretary, Joseph Chamberlain, who was also an ardent federationist. He proposed that Great Britain return to a protective basis by establishing a small protective tariff on imports brought from other districts than the British colonies, with the understanding that the colonies would reciprocate by reducing their customs rates on British products. This project was put forward in a systematic way in 1903 and was an important plank in the platform of the Conservative-Unionist party in the Parliamentary elections of 1905. The free-trade tradition in Britain, together with the tendency of British labor to favor the Liberals, proved, however, too strong for Mr. Chamberlain, and his party and program went down to defeat in 1905. The colonies, however, had already begun to extend preferential duties to British products since Canada initiated the practice in 1897. The World War finally produced the realization of Mr. Chamberlain's dreams after his death. Great Britain adopted a protective tariff during the war and the imperial war conference of 1917 declared strongly for imperial preference. In the third place, imperial defense has occupied the attention of the statesmen of modern British imperialism, especially since the beginning of the 20th century. With respect to naval defense, some of the colonies, such as Canada, South Africa and New Zealand, have contributed to the strengthening of the British imperial fleet, while Australia has chosen to build and maintain its own navy. All of the self-governing colonies have made provision for military service and have provided efficient local armies. The Australian fleet and the soldiers of all the self-governing colonies participated in force and with great distinction in the late World War, and the war conference of 1917 came out for the necessity of a more scientific determination and provision of imperial defense. The World War has had most significant but what are as yet incalculable effects upon the United Kingdom and its relations with the self-governing colonies. The immediate and extensive rallying of the colonies to the support of the mother-country indicated the strength of the bond of sentiment uniting the mother-country and the self-governing colonies. At the same time, during the war the exploits of soldiers from the various colonies tended to inflate the pride of the colony from which they came and to react even more in the direction of nationalism than in that of imperial solidarity. In the Peace Conference, also, it was apparent that the representatives of the colonies would not sanction any diplomatic action by the United Kingdom which impaired or threatened any of their vital local or national interests. Especially was this true of Australia. While it is difficult to forecast just what the outcome will be in the final adjustment between colonial nationalism and imperial sentiment, it would appear safe to pre-

dict that the self-governing colonies will never again be subordinated to any important control through Downing Street. At present, while Great Britain has a formal control over those colonies through the royal governor, the veto over colonial legislation, the control of colonial foreign relations and the right of appeal over colonial courts to the Privy Council of the United Kingdom, it is safe to hold that, except in the case of a lesser colony like Newfoundland, Great Britain will never attempt to dominate colonial policy or coerce a colony, except in those matters of foreign relations which might, through colonial pugnacity, involve the whole empire in a costly war.

(SEE EXTENSIVE ARTICLES ON EACH OF THE SELF-GOVERNING COLONIES).

Next in order of importance are the crown colonies. These represent the holdover into the present era of what was a typical colonial policy in the original period of colonial administration. One important difference, however, exists, namely, that the modern crown colonies have tended to lose their elective legislatures. Of the older variety possessing an elective legislative body only the Bermudas, Bahamas and Barbados remain. Next come the Leeward Islands, British Guiana, Malta, Mauritius and the Fiji Islands, where the elective members of the colonial legislature are less in number than those appointed by the mother-country. The most numerous of all the grades of crown colonies is the third, in which all the members of the legislative body are appointed by the mother-country. Such are most of the British West Indies, Ceylon, the colonies in tropical Africa and the majority of those in Oceania. Finally, there are small and lightly populated military posts and naval bases, such as Gibraltar and Saint Helena, which possess no legislature at all. Like the crown colonies, colonial government through chartered companies is a heritage of the old colonial movement. In the present empire, however, there are only two such colonies, Rhodesia in southern Africa and northern Borneo. The protectorates in the British Empire exist primarily where a penetration of new territory is in process and is preparatory to a more firm foothold, where the native customs and political organization are of a sort that is best left without interference, or where among a more highly developed people there exists a strong nationalistic sentiment which will not permit a thorough-going form of administrative union with the mother-country. Examples are the Malay Peninsula, Zanzibar, Bechuanaland and Egypt. Persia seems in process of development into a protectorate. The "Empire of India" is difficult to classify from an administrative standpoint. It began as a government by a chartered company, was transformed into a crown colony following 1857 and now seems well on the road toward a self-governing colony. Again, not only historical, but also ethnographic and cultural factors complicate the situation in India, for certain highly civilized parts are administered practically as a self-governing colony and more backward portions as differing types of crown colonies. Finally, there are the few mandatories which have been given to Great Britain as a result of the conquest of the German colonial possessions during the World War. They are akin to a protectorate administered under an alleged international supervision. Some are controlled directly by Great Britain, as in the case of German East Africa, while others, such as German Southwest Africa or the German islands in the Pacific south of the equator, are directly supervised by a self-governing colony. Perhaps the most novel and interesting thing about this new type of administration is that the Union of South Africa, Australia and New Zealand have themselves begun to enter upon an imperialistic expansion of their own.

Of the future of the British Empire it is difficult to speak with certainty. There is no doubt that Great Britain has reached a more complete relative supremacy as a power in imperial and colonial politics than has been the case since the collapse of France in 1763. Both of her most dangerous rivals, Germany and Russia, are now helpless, one conquered and the other in a state of disintegration. Her naval domination is complete and her merchant marine is still far in the lead among all powers, in spite of losses during the war. All of these circumstances would seem to make it apparent that Great Britain might not need to retain any dominating political grip upon her imperial possessions in order to enjoy all the commercial benefits which have come to her as a great colonial power. On the other hand, such policies as imperial preference and imperial defense are likely to lead to a greater degree of imperial cohesion. Then there is the opposition to any thought of imperial dissolution which would arise from the vast body of civil servants who are engaged in colonial service at home and abroad and derive their income from this activity, and from the still more powerful group of large investors in colonial securities and resources who would regard their investments as likely to be jeopardized by a loss of imperial control of the territory. Nor are there lacking political reasons why the empire should persist. Japan seems destined to rival Great Britain as a colonial power of the future and this will create the necessity of a strong British policy in the Pacific area and the Far East generally. A still more ambitious plan than a retention and strengthening of the British Empire is the program of a considerable group of Americans and Englishmen, namely, the union or firm political alliance of the "English-speaking peoples." This project was foreshadowed as early as the middle of the 18th century by Thomas Pownall, governor first of Massachusetts and then of South Carolina, was advocated by Joseph Chamberlain, and its historical background and practical advantages have been made the subject of recent scholarly treatises by such American writers as George Louis Beer and Sinclair Kennedy. The co-operation of the two countries in the World War has brought a closer feeling of unity, and the promise of a more sympathetic study of the history and institutions of each state by the other. See BRITISH EMPIRE; GREAT BRITAIN — FOREIGN POLICIES, BRITISH COMMERCE, BRITISH SHIPPING, BRITISH NAVY.

7. Modern Imperialism and the World War. — It is difficult at present to analyze satisfactorily the causes of the late World War. It would seem, however, that the causes may be divided into two main classes, those which

EXPLANATORY KEY
1. Schleswig plebiscite.
2. Heligoland, to be dismantled.
3. Moresnet, ceded to Belgium.
4. Eupen
5. Malmedy
To be decided by League of Nations
6. Saar Basin, under French control.
7. Alsace-Lorraine, ceded to France.
8. Loebschütz, ceded to Czecho-Slovakia.
9. Upper Silesia plebiscite.
10. Area ceded to Poland.
11. Danzig, a free city.
12. East Prussia, plebiscite.
13. Memel, to be decided by Allied and Associated Powers.
14. Area ceded to Italy.
15. Klagenfurt, plebiscite.
16. Area disputed by the Serb-Croat-Slovene State and Italy.
17. Transylvania, claimed by Roumania.
18. Bukowina, claimed by Roumania.
19. Galicia, to be divided between Poland and Ukrainia.
20. The frontier with Serbia to be modified.
21. Western Thrace, to be decided by Allied and Associated Powers.
22. Roumania will probably cede Dobrudja to Bulgaria.
23. Eastern Thrace to be decided by Allied and Associated Powers.
24. Finland, republic; recognized by Allied and Associated Powers.
25. Esthonia, republic; recognized by Great Britain.
26. Latvia
27. Lithuania
declared themselves independent republics in 1918.
28. Ukrainia, republic; recognized by Allied and Associated Powers.
29. Daghestan
30. Georgia
31. Azerbaijan
Caucasian States, independence proclaimed April 22, 1918.
32. Armenia, (part of) independence proclaimed August, 1918.
OLD BOUNDARIES, 1914
NEW BOUNDARIES SHOWN IN TINTS
ATLANTIC
NORTH SEA
BRITISH ISLES
SHETLAND ISLANDS
ORKNEY ISLANDS
HEBRIDES
SCOTLAND
IRELAND
IRISH SEA
ENGLISH CHANNEL
St. George's Channel
BAY OF BISCAY
DENMARK
GERMANY
FRANCE
SWITZERLAND
AUSTRIA
SPAIN
PORTUGAL
MADRID
LISBON
CANTABRIAN MTS.
BALEARIC ISLANDS
MAJORCA
MINORCA
CORSICA (Fr.)
SARDINIA (It.)
TYRRHENIAN SEA
ADRIATIC
GULF OF GENOA
MEDITERRANEAN
MOROCCO
ALGERIA
TUNIS
AFRICA
Skagerrak
Christiania
Stavanger
Bergen
Hamburg
Berlin
Amsterdam
Brussels
Paris
Milan
Vienna
Prague
Gibraltar
Tangier
Oran
Bizerta
Tunis
Cape Finisterre
Cape Spartivento
Cape Bon
Strait of Gibraltar
Strait of Bonifacio
Strait of Messina
Gulf of Lyons
Gulf of Genoa
Gulf of Tunis
Gulf of Sidra
Gulf of Gabes
Gulf of Hammamet
Gulf of Cabes
Gulf of Sirte
Gulf of Sidra
Gulf of Gabes
Gulf of Hammamet
Gulf of Cabes
Gulf of Sirte

E 1919

NEW EUROPE
SCALE
BLACK SEA
SEA OF AZOV
CASPIAN SEA
ARCTIC
TURKEY
ASIA MINOR
PERSIA
FINLAND
ESTHONIA
LATVIA
LITHUANIA
POLAND
GERMANY
ROUMANIA
BULGARIA
GEORGIA
AZERBAIJAN
DAGHESTAN
MOSCOW
PETROGRAD
CONSTANTINOPLE
URAL MOUNTAINS
EUROPE
ASIA

EUROP

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SWITZERLAND
ITALY
CORSICA
SARDINIA
BALEARIC ISLANDS
MEDITERRANEAN
AFRICA
MOROCCO
ALGERIA
TUNIS
SICILY
TYRRHENIAN SEA
SERB-CROAT
SHETLAND ISLANDS
ORKNEY ISLANDS
HEBRIDES
SKAGER-RAK

E 1919

NEW EUROPE
SCALES
Statute Miles, 286 — 1 Inch.
Kilometres, 460 — 1 Inch.
Rand McNally & Co.'s 11 x 14 Map of New Europe
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RUSSIA
FINLAND
ESTHONIA
LATVIA
LITHUANIA
POLAND
PRUSSIA
GERMANY
UKRAINIA
ROUMANIA
BULGARIA
TURKEY
PERSIA
BLACK SEA
CASPIAN SEA
SEA OF AZOV
WHITE SEA
ARCTIC OCEAN
AEGEAN SEA
MEDITERRANEAN SEA
ASIA MINOR
DAGHESTAN
GEORGIA
AZERBAIJAN
ARMENIA
PETROGRAD
MOSCOW
CONSTANTINOPLE
HELSINGFORS
Kara Strait
Yugorski Shar Str.
Kolguev Is.
Novaya Zemlya
Ob River
Yenisei R.
Lena R.
Volga R.
Don R.
Dnieper R.
Dniester R.
Vistula R.
Oder R.
Elbe R.
Danube R.
Rhine R.
Mouths of the Danube
Mouths of the Volga
Gulf of Finland
Gulf of Bothnia
Gulf of Riga
Gulf of Archangel
Gulf of Kandalaksha
Gulf of Onega
Gulf of Taganrog
Gulf of Perekop
Gulf of Ikonderun
Sea of Marmora
Aegean Archipelago
Lake Ladoga
Lake Onega
Lake Peipus
Lake Ilmen
Lake Mangut
Lake Stavropol
Lake Urmia
Lake Van
Lake Sevan
Caucasus Mts.
Ural Mts.
Carpathian Mts.
Balkan Mts.
Taurus Mts.
Kara Sea
Barents Sea
Nordkyn
Vardö
Varanger Fjord
Fisher I. or Kildachi Pen.
Kanin Peninsula
C. Kanin
C. Gorodetskii
Gulf of Cheshskaya
Arctic Circle
Pechora R.
Mezen R.
Dvina R.
Onega R.
Kem R.
Kovda R.
Tuloma R.
Paz R.
Pasvik R.
Pechenga
Petsamo
Kolosjoki
Kolari
Kemitrask
Kandalaksha
Kamenak
Soroka
Archangel
Kholmogory
Karpagorskii
Mezen
Pinega
Ust Uchta
Dutof
Ust Tsylma
Ust Usa
Pustozersk
Ust Waga
Shenkursk
Yarenak
Ust-Sysolsk
Cheredyn
Kai
Ustyug Velikiy
Lalsk
Kargopol
Velsk
Totma
Nikolsk
Kologriv
Orlov
Vyatka
Nolinsk
Motovilikha
Perm
Ekaterinburg
Chelyabinsk
Kungur
Osa
Ufa
Zlatoust
Troitsk
Sarapul
Izhevsky
Votkinsk
Glazov
Sterlitamak
Bugulma
Buguruslan
Buzuluk
Orenburg
Orsk
Uralsk
Ural R.
Emba R.
Guriev
Astrakhan
Petrovsk
Derbent
Cape Apsheron
Baku
Lenkoran
Kuban R.
Terek R.
Sukhum Kale
Batum
Kutais
Poti
Tiflis
Gori
Gagra
Novorossisk
Anapa
Taganrog
Rostov
Novocherkask
Alexandrovka
Mariupol
Berdyansk
Berislav
Aleshki
Kherson
Nikolaiev
Tiraspol
Odessa
Akkerman
Ismail
Galatz
Reni
Bucharest
Braila
Giurgevo
Silistria
Rustchuk
Varna
Kalakra
Dobrudja
Philippopolis
Adrianople
Constantinople
Bosporus
Dardanelles
Gallipoli
Rodosto
Smyrna
Adalia
Adana
Mersina
Alexandretta
Aleppo
Cyprus (Br.)
Crete
Rhodes
Sinope
Amasiera
Trebizond
Kars
Erivan
Alexandropol
Tiflis
Gori
Kutais
Poti
Batum
Baku
Lenkoran
Petrovsk
Derbent
Astrakhan
Mouths of the Volga
Caspian Sea
Persia
Tabriz
Urmia
Lake Urmia
Lake Van
Lake Sevan
Mesopotamia
Bagdad
Mosul
Tigris R.
Euphrates R.
Basra
Persian Gulf
Arabia
Red Sea
Egypt
Suez
Cairo
Alexandria
Port Said
Tripoli
Barca
Cyrenaica
Tripolitania
Fezzan
Algeria
Tunis
Tunis (Fr.)
Malta
Gozo
Sicily
Palermo
Messina
Catania
Syracuse
Trapani
Marsala
Corsica
Sardinia
Cagliari
Bastia
Ajaccio
Bonifacio
Balearic Islands
Majorca
Minorca
Ivica
Gibraltar
Spain
Portugal
Morocco
Tangier
Fez
Rabat
Casablanca
Mogador
Algiers
Oran
Bona
Constantine
Biskra
Tuggurt
Ghadames
Ghat
Murzuk
Kufra
Sollum
Tobruk
Derna
Benghazi
Bomba
Khoms
Misurata
Sirte
Tripoli
Gabes
Sfax
Kairouan
Sousse
Tunis
Bizerta
Cape Bon
Cape Matapan
Cape Malea
Cape Spada
Cape Sidero
Cape Salomon
Cape Krio
Cape Apsheron
Cape Tarkhankut
Cape Fiolent
Cape Aia
Cape Kaliakra
Cape Emine
Cape Kherson

it in two different aspects, namely the process of extending European civilization to lands overseas and the reaction of this expansion upon European culture itself. There can be no question that much the most important phase of the extension of European culture since 1870 has been the carrying of the material culture, especially the machine technology of Europe, throughout the world. In some cases it has not been widely adopted by the native populations, especially in the case of primitive tribes, but even in such areas it has been transplanted among the white settlers and has been the means of obtaining that supremacy of the white over the native black which has everywhere accompanied the coming of modern imperialism. The more conspicuous effects of the extension of the machine technology have been evident in the case of such older civilizations as those of Japan, China and India, where even a partial introduction of the more advanced industrial methods has wrought a complete transformation of the external aspects of their civilization. Further, if it be true that economic processes tend ultimately to shape the other phases of civilization, then this economic transformation will bring a general cultural revolution. The industrial changes in Asia which are now taking place will afford the most extensive social laboratory which could be imagined in which to test the validity of the Marxian theory of cultural development. Certainly the political and educational changes which have already been observable in Japan and China would indicate the coming of a general cultural readjustment. Along with the machine technology has gone the various phases of modern applied science, not only that which is directly related to industry, but also the sanitary and medical sciences which have done so much to save lives and reduce suffering. One of the earliest and always the most energetic and all-pervading channels for the transmission of certain phases of European civilization has been the activity of the missionaries. The importance of their work will be differently estimated according to the theological outlook of the historian. If he retains a belief in orthodoxy he must regard the conversion of millions of Africans and Orientals and the salvation of their souls from eternal torment as far and away the outstanding achievement of overseas expansion. If, on the other hand, he rejects the Christian dogmas he must view the missionary enterprise as an audacious and arrogant meddling with the local beliefs and institutions of other peoples. But the orthodox and the sceptic alike must pay tribute to the non-religious phases of missionary activity, such as the introduction of better medical, sanitary and industrial practices, and the teaching of the elementary facts of Western knowledge. In the political realm the extension of European institutions has been of a mixed character. In the government of backward peoples there has been little real political education or liberalism, except perhaps in such cases as the government of the Philippine Islands. In most instances it has meant a superimposition of an autocratic white bureaucracy which has been quite as oppressive, even if more efficient than the native governments. On the other hand, there can be no doubt that the imitation of Western political theories and institutions by such states as China and Japan will be conducive to a greater degree of liberty and political efficiency than would ever have been possible under the old régime. In the matter of the extension of social customs so little has been accomplished that it would be difficult to generalize. In most cases the European governments have found it best to interfere as little as possible with native social customs, except in the case of what is obviously both cruel and useless. The abolition of infanticide, the suttee and some of the more painful and repulsive religious rites of the natives are definite examples of progress due to the contact with European customs. Much has been done by missionaries in the attempt to improve the sex *mores* of the natives and the Orientals, but as to how much positive progress is involved in the introduction of the Patristic "impurity complex" among overseas populations is a question upon which students of comparative ethics and modern medical psychology have differed with the missionaries. Lest one might be inclined to regard the European expansion as a wholly beneficent process it is necessary to call attention to certain detrimental effects of the contact of European peoples with those overseas. In economic matters Western industry and commerce, when introduced, mean the development of modern capitalism with all of the misery which it has entailed in Western states. Further, there has been a general tendency to exploit native labor, not only in factories and mines, but also on rubber plantations and in agricultural activity, and to oust the natives from their lands when these possess valuable mineral deposits or other important products of commercial significance. Then, over against the saving of native lives by the introduction of modern medical and sanitary science, must be set the introduction or development of the use of alcoholic liquors and opium products which has brought about not only a great loss of life among natives, but also unspeakable misery and serious physical deterioration. In the field of religious endeavor one should not forget the frequent persecution of those natives who persevere in their older beliefs, the protection by missionaries of criminals guilty of atrocious crimes, as was the case in China previous to the Boxer rebellion, and the frequent oppressive economic exploitation of natives, as was well exemplified in the conduct of agrarian operations by the Spanish friars of the Philippines. The undoubtedly superior efficiency of European political control over colonies and the greater liberalism brought in through the Oriental limitation of Western constitutions have been paralleled by extreme autocracy and cruelty in colonial administration, especially in dealing with native revolts or crimes. Cases in point are the administration of Leopold in Belgian Kongo, the German suppression of the Herero revolt in southwest Africa and the general administration of Karl Peters in German East Africa, the attempted extermination of the natives by the English settlers in Australia and New Zealand and the conduct of the American military forces in coercing some of the more warlike tribes in the Philippines. Nor has the social side of the contact between Europeans and natives been without unfortunate results. European vices have been introduced for native imitation, especially the use of alcoholics, and, at the same time that missionaries were

trying to inculcate the sexual *mores* of Western monogamy, the white traders and others were systematically debauching the morals of the native women. While one cannot question the fact that the expansion of European civilization has brought a vast amount of material progress to the world at large, it seems equally true that the natives have lost more than they have gained by the process. If this be true, then the progress of modern imperialism can only be justified as Mr. Roosevelt upheld the conquest and expropriation of the American Indian, namely, on the ground that the lower civilization must give way before the advance of the higher.

It has generally been held that all the outstanding results of overseas expansion have been limited to the extension of Western culture to the peoples overseas, but there have been equally notable reactions produced upon European culture and institutions by this process of expansion. In the matter of the economic reaction of expansion upon Europe one of the most significant results has been the introduction of new commodities, extremely important articles of industry like rubber, petroleum and nitrate of soda; food products and beverages, such as tropical fruits, rice, cocoa and tea; and articles of ornament, as in the case of Chinese and Japanese ware and Indian ornamentation. The discovery of these new commodities and the stimulation of diversified industry overseas has promoted the development of a greatly extended international division of labor. Commercial mechanisms and financial institutions have been greatly altered as a result of the discoveries and the increased trade which accompanied the more recent phases of imperialism. While one should not neglect the significant beginnings of credit institutions and other devices to aid commerce in the old colonial movement, the mechanism of commerce in 1800 was extremely crude as compared with that which has developed in the last 50 years to expedite world trade. Again, the volume of money in circulation has been greatly increased, not only by the growth of business, but also by the discoveries of the precious metals in Australia, South Africa and other overseas territories. Finally, the growth of the world trade has stimulated the increase of capitalism quite as much as this has been promoted by it. The political reaction of imperialism upon Western society has been almost wholly unfortunate. The autocratic government of natives has tended to react to the weakening of democratic institutions at home. Then, the burden of imperial administration has proved to be a severe drain upon national resources and has lessened the funds available for advanced social legislation. To this must be added the important part which modern imperialism has played in the recent development of armaments on both sea and land and in producing the most expensive and deadly tragedy of history in the late World War. The only valuable contribution of imperialism in its political reaction upon Europe has been the training it has afforded in colonial administration. In addition to the earlier policies of subjection and partial autonomy, which were typical of the colonial administration in the old colonial movement, there have been three other policies contributed in the more recent era, complete autonomy, as in the case of the British self-governing colonies; assimilation, or adaptation to Western culture, practised, for example, by France in northern Africa; and association, in which native customs are respected and the native culture allowed to develop along natural lines, though affected by the introduction of new industrial methods and subject to a general oversight of Europeans, cases in point being India, Egypt and Zanzibar. In the field of natural science overseas expansion has been most potent in leading to revolutionary progress. It is conventionally supposed that scientific advances have come almost entirely from isolated work in European and American laboratories, but it would be easy to demonstrate that much of modern scientific progress has come from research in the realm of the greater laboratory of the scientific data of nature which has been opened to many by explorations overseas. In the field of geography there have been contributed, not only the great mass of new data and the perfection of cartography, but also the development of physical geography in all its phases since Alexander von Humboldt, and the analysis of the influence of the various physical environments of the earth upon man and social institutions in the writings of Ritter, Peschel, Ratzel and Reclus. Astronomy has been perfected through the possibility of a wider and more accurate observation of the heavens after modern explorations had begun. In biology and zoology, not only has a vast amount of new data been brought together which has overthrown much of the systems of classification of Linnaeus, Buffon and Cuvier, but also the observation of the diverse species of plants and animals throughout different parts of the world enabled Darwin, Huxley and Wallace to formulate the greatest discovery of the 19th century in biological science, namely, the law of evolution. Both chemistry and the 'materia medica' have been infinitely enriched by discoveries made during overseas expansion. Not less significant has been the reaction of overseas discoveries on social science. Without the data supplied by the observation of a great number of different cultures and peoples there could have been no such sciences as anthropology, ethnology, comparative philology, comparative religion, comparative jurisprudence, descriptive sociology, evolutionary politics and historical economics. Nor has the overseas expansion been without its significance in providing the knowledge and *motif* for important contributions to philosophy, literature, the drama and music, as will be evident from noting the influence of the 'Shakuntala' of Kalidas upon Herder, Goethe and the Romantic movement in European literature, of the 'Geeta' upon modern European philosophy, and of the teachings of Manu upon the doctrines of Nietzsche. It is these little-recognized but all important cultural contributions which have accompanied recent overseas expansion that must be set off against its detrimental effects when one attempts to assess the total significance of modern imperialism for European civilization. While there have been certain sporadic attempts to imitate Oriental social customs, it must be admitted that the social reaction of expansion on Western civilization has been effective chiefly in an indirect manner due to the effects upon social customs of the broader cultural changes which

have been briefly summarized. If, in conclusion, one were to raise the question of the probable future of imperialism little can be said further than that it seems to be a function of capitalism and *Machtpolitik* and is not likely to decline as long as these forces and principles remain operative, and their abatement does not appear imminent. It would seem, however, that, except in the event of another world war, the imperialism of the future will have to be carried on primarily by economic rather than political means, as most of the formerly unoccupied areas of the earth have now been appropriated by the stronger powers.

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WORLD POWER, United States as a. See UNITED STATES — DIPLOMACY; UNITED STATES — FOREIGN POLICY.

WORLD SPEED RECORDS. See SPORTS.

WORLD'S COLUMBIAN EXPOSITION, an international exposition held in Chicago, Ill., in 1893, to celebrate the 400th anniversary of the discovery of America by Columbus.

History.— The fitness of some special celebration of the discovery of America had been recognized and the question agitated several years before the bill providing for a Columbian Exposition was introduced in Congress in 1889. Several cities urged their claims for the site of the exposition; chief among them were New York, Chicago, Washington and Saint Louis; Chicago was finally chosen as the site and the bill passed and approved 25 April 1890. The organization of the fair was placed under the charge of an Illinois corporation previously organized, and the World's Columbian Commission, a national commission consisting of delegates appointed two from each State and Territory, two from the District of Columbia and eight at large. The work of construction was placed under the charge of a Bureau of Construction, of which Daniel H. Burnham was chief; work was begun on the first building in July 1891. On 23 Oct. 1892 the buildings were formally dedicated by the Vice-President of the United States; the dedication ceremony, which was attended by 130,000 people, was held in the Manufactures and Liberal Arts Building. The exposition was formally opened 1 May 1893 by President Cleveland; at the moment when he declared the fair open the flags of the various nations were unfurled, the electric fountains turned on, and the statue of "The Republic" unveiled. The attendance at the fair was 27,539,041, of which 21,479,661 were paid admissions; the days showing the largest attendance were 9 October, Chicago Day, and 4 July, American Independence Day; the average daily attendance was 172,712. The exposition was formally closed 30 October.

Financial.— The bill providing for the exposition required the city of Chicago to raise $10,000,000 toward the expenses; later Congress provided for the gift of a special mintage of $2,500,000 in souvenir half-dollars, the exposition authorities also issued $5,000,000 worth of debenture bonds; about $3,000,000 additional were received from other miscellaneous sources, so that about $20,000,000 was available before the opening; the total expenditures for the fair were over $31,000,000, and the profits about $1,850,000. The United States government appropriated $2,250,000 to its exhibits, the States $6,060,350, the foreign governments $5,830,000, and over $350,000 was invested in the Midway Plaisance.

Buildings and Principal Exhibits.—The site chosen for the exposition was Jackson Park, a portion of the South Park system of Chicago; it covered 666 acres and extended about two miles along the shore of Lake Michigan. There were about 150 buildings erected; the more important were built of the material called "staff," a composition of plaster of Paris and jute fibre, which produced the general effect of white marble, hence the exposition grounds became generally known as the White City. The Manufactures and Liberal Arts Building faced the lake near the eastern end of the basin; this was the largest building ever constructed for an exposition; it covered nearly 31 acres; the main roof was of iron and glass. At the head of the basin was the Administration Building, with its gilded dome; near this were the Agricultural Building, Machinery Hall, and the Electrical and Mining Building. On the west of the lagoon were the Transportation Building and Horticultural Hall, and on the east the Government Building, with a large dome 150 feet high; at the northwestern end of the lagoon was the Woman's Building, and at the northeastern end the Fisheries Building. Still further to the north were the State buildings, many of the foreign nations' exhibits, and the Fine Arts Building. The Fine Arts Building was an example of purely classical architecture; it was entered by four richly ornamented portals. The State and foreign nations buildings were in many cases copies of some characteristic historic building or type; as, for example, Virginia's building was modeled on Washington's Mount Vernon home, Massachusetts' was a copy of John Hancock's house; England's represented a manor house of the time of Henry VIII, and Spain's the Convent of La Rabida. In the southern part of the grounds was the Forestry Building, built in the rustic style; the columns supporting the roof being made of tree trunks furnished by the different nations and the States and Territories of the United States. Near the Forestry Building were a number of the small exhibits, the Krupp exhibit, dairy, etc. The Manufactures and Liberal Arts Building included in its exhibits everything related to engineering, architecture, publishing, technical and domestic arts, together with education, the professions, music and the drama. The Fine Arts exhibit included many masterpieces of painting and sculpture, the Woman's Building containing a collection representing woman's work in all lines of activity; the Transportation Building's collection represented all modes of transportation from the most primitive to the most complete modern

inventions of ocean steamers and locomotives; and the exhibits of the other special departments of human industry showed most excellently the progress of the race in each special industry.

Special Features.—Among the special features of the exposition the Midway Plaisance was perhaps most interesting; on this were represented the villages of different nations and peoples, including the Irish village, the Javanese village, the Japanese bazzar, the Samoan and Dahomey villages, etc.; here also were the "Street of Cairo," and the various amusement features; and the Ferris wheel, 250 feet in diameter, carrying 36 coaches. Other special exhibitions of interest outside the main buildings were the reproduction of the cliff dwellers' buildings at Battle Rock Mountain, Colo.; the models of Columbus' three caravels, of the Viking ship, and of a modern United States battleship. Another interesting feature of the exposition was the numerous world's congresses held on the grounds under the auspices of the World's Congress Auxiliary. These congresses discussed the leading phases of professional, scientific, economic, educational and religious thought; the World's Parliament of Religions probably attracted the most general attention. Consult Johnson, Rossiter (ed.), 'History of the World's Columbian Exposition Held in Chicago in 1893' (4 vols., New York 1897–98).

WORLD'S PARLIAMENT OF RELIGIONS. See CONGRESS OF RELIGIONS.

WORM, or SCREW GEARING are gears connecting shafts that are not parallel and do not meet, and the elements of whose teeth are helical or screw-like. The worm is a screw, sometimes termed an endless screw, made to mesh with the teeth of a wheel called the worm-wheel. The axis of the worm is usually at right angles to the axis of the worm-wheel. Worms are usually made for single curve gear-teeth, because the sides of involute rack teeth being straight, the tool for cutting worm-teeth is easily made. Special gear-cutting machines are used to cut worm-gears. See GEARS.

WORM-EATING WARBLER, a small, ground-keeping warbler (q.v.) of the United States (*Helmintheros vermivorus*), breeding commonly in the woods of the eastern part, and migrating in winter to Central America. It is five and one-half inches long, olive-green above, yellowish-white below, the distinguishing specific mark being three black stripes on the buffy crown. Its song is a faint trill, heard most often in hilly woodlands, where the bird hunts for caterpillars and similar food among the lower branches of the bushes or upon the ground. Its nest is constructed with great skill in some little natural cavity of a hillside, and is cleverly hidden under an arch of twigs and old leaves, so disposed as to well conceal the white, red-speckled eggs. The mother uses the trick common to so many ground-building birds, of feigning lameness, fluttering ahead of the intruder in a frantic attempt to draw him away from the nesting-place in vain pursuit of herself.

WORM FEVER, popular name for the disease formerly described as *infantile remittent fever*, but now known to be typhoid fever in young children.

WORM-SEED, the flower-heads of certain species of Artemisia (q.v.) used as a vermifuge. See also ERYSIMUM; GOOSEFOOT.

WORM-SHELL, one of the curiously uncoiled and distorted gastropod mollusks of the marine family *Vermetidæ*, whose shells might easily be mistaken for the tubes of annelids, such as Serpula. They are free and spiral in early life, and crawl about like ordinary gastropods, but they afterward settle down and become attached to stones, etc., for the remainder of their lives. The animals are worm-like, with a short proboscis, horny jaws and radula and two short tentacles. When they become stationary the foot, being of no further use as a locomotive organ, becomes modified into an organ of attachment, and the shell stretches out irregularly. The species are not numerous and occur mainly within the tropics of Eastern seas.

WORMELEY, wèrm'li, **Katharine Prescott,** American author and translator: b. Ipswich, England, 14 Jan. 1830; d. 4 Aug. 1908. She was the daughter of an English rear-admiral and a niece of Com. Edward Preble of the American navy, and came to the United States in girlhood. She was engaged in the relief of Union soldiers during the Civil War and was connected with the United States Sanitary Commission. She was widely known as a translator of Honoré de Balzac's novels in 40 volumes (1883–97); of Molière in 6 vols. (1892); and of the Duc de Saint-Simon's 'Memoirs' (20 vols., 1898–1901); and wrote 'Letters from Headquarters during the Peninsular Campaign' (1862); 'The Other Side of War' (1888); 'Life of Balzac' (1892); 'The United States Sanitary Commission' (1863).

WORMS, vôrms, Hesse-Darmstadt, town on the Rhine, nine miles northwest of Mannheim. The town is irregularly built and has remains of its mediæval walls and ramparts. Its principal building is the cathedral, completed and consecrated in 1101, a noble Romanesque structure with four elegant towers, two domes, a double choir and a flamboyant 15th century Gothic portal. The interior is 357 feet long, 87 feet wide, across the transepts 117 feet and is very imposing from its grand simplicity. On the north side of the cathedral is the site of the Bischofshof or episcopal palace, the seat of the celebrated Diet of Worms in April 1521. It was destroyed by the French in 1689, and again in 1794. On its massive red sandstone substructure the Heil'sche Haus has been erected in the rich Renaissance style. The restored church of Saint Martin, and the church of Saint Paul secularized as a museum, are also of notable ecclesiastical architecture. Outside the town stands the Liebfrauenkirche (dating from the 15th century), which gives its name to the Liebfrauenmilch, a much-esteemed wine grown in the vicinity. The finest monument in Worms is that to Luther, erected from Rietschel's designs in 1868 at a cost of $85,000. Worms is a considerable river port with a good harbor and an active shipping trade. The principal industries of Worms are the manufacture of patent leather, machinery, worsteds, chicory, slate, tobacco, beer, soap and amber wares. Worms is one of the most historical towns of Germany. It was known to the Romans as *Borbetomagus*, and later as *Augusta Vangionum*,

the capital of the Vangiones. It was destroyed by Attila and rebuilt by Chlodwig in 486. After the partition of the empire among the sons of Ludwig the Pious, Worms became a German free town under the protection of the Elector of the Palatinate. Already in 1255 it belonged to the Confederation of Rhenish towns, and it contained in the time of Frederick Barbarossa 70,000 inhabitants. It was the seat of many Imperial Diets, most famous that under Karl V, at which Luther made his defense. In 1632 the suburbs of the town were leveled by the Swedish Colonel Haubold, and in 1689 the town itself was ruthlessly destroyed by Melac and the young Duc de Créqui under the orders of Louis XIV. In September 1792 part of it was leveled by the French under Custine; at the peace of Lunéville in 1801 it was given to France. The peace of Paris in 1814 gave it back to Germany, and the Vienna Congress in 1815 to Hesse-Darmstadt. Pop. 46,891. Consult Fuchs, 'Geschichte der Stadt Worms' (Worms 1868); 'Beiträge zur Geschichte der Stadt Worms' (Worms 1896); Nover, 'Das alte und neue Worms' (Worms 1895).

WORMS, vorms, island in the Baltic, east of Dagö, belonging to Esthonia, about 36 square miles in area. It is flat and generally well wooded in the interior and throws out numerous steep promontories, round which strong currents run, so that, often for months together, it is cut off from all intercourse with the neighboring islands of Oesel, Dagö, Runö, etc., as well as with the mainland, and thus the inhabitants who are of Swedish origin have remained unmixed with foreign elements. A stranger is a surprising rarity on this island, and he, in turn, is not less surprised at the peculiar old Swedish dialect, the architecture and the manners and customs of this small, poor, but happy insular people.

WORMS, any of many elongated jointed animals; the term has no more definite signification or limits than has Vermes (q.v.). Examples of what may most properly be called worms are earthworms, leeches, marine annelids and the parasitic flatworms, roundworms, etc., especially such as infest the intestinal tract. These are described elsewhere, under their names. See also PARASITES.

WORMWOOD, a perennial herb (*Artemisia absinthium*) of the composite family. It is a native of Europe and northern Asia, whence it has been introduced into other countries by way of gardens in which it was formerly cultivated for domestic medicine. The plant grows about three feet tall, is spreading, bears silky, pinnatifid leaves and yellow flowers in heads arranged in racemes. All parts of the plant are intensely bitter on which account they, the leaves especially, have been used for flavoring drinks. Wormwood is cultivated to some extent for the manufacture of absinthe (q.v.), of which it forms one of the most important ingredients and which is named from it. See ARTEMISIA.

WORSHIP, the act of paying divine honors to the Supreme Being; or the reverence or homage paid to Him in religious exercises, consisting in adoration, confession, prayer, thanksgiving and the like. The Christian Church distinguishes between the worship due to God alone (*datria*), the respect paid to the saints (*dulia*) and the worship due to the Virgin Mother of Christ (*Hyperdulia*). The homage paid to idols or false gods by pagans is idolatry. "Worship" is also a title used in Great Britain and some British colonies in addressing certain magistrates. See LITURGY; PRAYERS; RELIGION; RITUAL.

WORSHIP, Freedom of. (The word *worship* is derived from A. S. *weorthscipe* = *weorth*, worthy, + *scipe*, ship; it meant *worthiness* in O. E., and is now used to designate *reverence* for a person or a thing). Reverence is the honor due to another because of some excellence which he has and we have not. That excellence is either natural or supernatural. If we reverence another because of some natural excellence, which we have not, our worship is natural. By such natural reverence we honor our parents, because of a superior excellence in them. They gave us life itself. For that gift we can never sufficiently pay them back. By the excellence of parenthood they will ever be superior to us, and an object of natural reverence. Of natural worship and reverence this article does not treat.

1. Supernatural and External Worship.— If we reverence another because of some supernatural excellence, which we have not, our worship is supernatural. Now this supernatural excellence may be finite or infinite, created or uncreated. Supernatural reverence of another, because of infinite and uncreated excellence, is called *adoration*. Supernatural reverence of another, because of finite and created excellence, has among Catholics the technical, figurative name of *dulia* — from *doulèia*, "slavery." Just as the subscription "Your obedient servant" means servitude only in a figurative sense, so the supernatural reverence of the saints is slavery only by a figure of speech. Moreover, among Catholics the reverence for the Blessed Virgin Mary is called *hyperdulia*, "more than *dulia*," to indicate that the homage paid to her is in a class by itself. It is not adoration, because the motive, objectively considered, is not infinite and uncreated. It is *dulia*; because the motive is finite and created. It is "more than *dulia*"; because divine motherhood, the motive of our reverence for Mary, though a finite and created excellence, is unique and in a class by itself. There is only one mother of the divine Person, Jesus Christ. Supernatural reverence — be it *adoration*, *hyperdulia*, or *dulia* — is either internal or external worship. Quite naturally one is free from State interference with one's internal worship; the State is not concerned with the acts of reverence, which one in no wise expresses by outward signs. The subject of this article is freedom, not of internal, but of external, supernatural worship.

2. Obligatory Worship.— This freedom of worship does not preclude man's obligation to religion, which flows from natural law. External, supernatural worship is not a matter of choice to man. Apart from the duty of religion, consequent upon his knowledge of God's supernatural revelation of Himself to the human race, man is by the very law of nature obliged to both internal and external supernatural worship. For man was created to praise, reverence and serve God. But man is

made up of both body and soul. Hence the faculties of his animated body, as well as the powers of his spiritual soul, should join in this praise, reverence and service of the Creator. That is to say, there should be an external manifestation of the reverence, which the mind conceives and the will elicits. "Ever since the creation of the world, the unseen truths about God,—that is, His everlasting power and divinity,—are to be seen by being reasoned out by means of His works. So that men have no excuse." (Romans i, 20). The religious freedom, whereof our article treats, is man's right to follow the dictate of his reason and the mandate of his will as to the manner of external worship. This right should be respected and protected by the State as it now is constituted. It is fundamental to our government. For the First Amendment to the Constitution ordains that "Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof."

Freedom of external worship, guaranteed to the individual by the Constitution of the United States, does not preclude the duty of civil society as such to give reverence to God. For God is the author and stay of civil society. Without Him and His gifts there would be no social organism. Hence is society bound to acknowledge His dominion and beneficence. The State recognizes its indebtedness to particular persons and to other States. America is not unmindful of the services of Lafayette and Rochambeau, nor of France that sent them to our aid. Much less should our State be oblivious of the infinite Being, on whom we depend for our existence and well-being. Nor are the United States forgetful of God. Witness the appeal of the signers of the Declaration of Independence to "the laws of nature and of nature's God," to the rights wherewith men "are endowed by their Creator," and "to the Supreme Judge of the world, for the rectitude of their intentions," when they pledged themselves to the support of the independence of the United States "with a firm reliance on the protection of divine Providence." Witness likewise the annual proclamation of Thanksgiving Day by the President of the United States.

The Church, as established by Christ, is a true and perfect society; it has its own inalienable rights, which the State should protect. Such protection is quite feasible, when society is entirely Catholic; but in a State such as ours, would be fraught with many and varied difficulties. Hence Catholics of the United States have always stood for justice to the consciences of each and all. Their principle of action in matters religious has been: Live and let live. Whereas at times Protestants seem to have called upon civil authority to impose on others their own religious tenets. In colonial days, the only real freedom of worship to be found was that of Maryland during the brief control of the colony by Catholics, 1634-89. As Bancroft says, in his 'History of the United States,' the Maryland Act of Toleration, 1649, was "the first in the annals of mankind to make religious freedom the basis of the State."

3. **Free Worship.**—In civil society constituted as is ours, the only feasible attitude of the State toward external worship is that of the First Amendment to the Constitution. Thereby is safeguarded by the United States the inalienable right, which her every citizen has to liberty of conscience. That right should be respected by civil authority. For authority, the unitive principle of the State, is from God. Therefore it may not validly impose an obligation to violate God's law. But to go against one's conscience is to violate God's law. For it is the function of conscience to dictate to us what is God's law in each particular case. Were the State so to legislate as to atrophy this function of conscience, it would seriously interfere with the observance of God's law. For it is the certain dictate of conscience that testifies just what particular form of worship is willed by God.

From this inalienable right, which each one has to worship God according to the certain dictate of conscience, we may conclude that, in a State such as ours, it would be ethically wrong to force one to practice even the true revealed religion. And this conclusion we draw, despite the fact that Christianity was established as a world-religion, which Jesus wished all to embrace. Just before the Ascension, He appeared to the eleven apostles in Galilee and said to them: "All power hath been given me in heaven and upon earth. Therefore go ye; make disciples of all nations; baptize them in the name of the Father and of the Son and of the Holy Ghost; teach them to observe all things whatsoever I have commanded you. And, lo, I am with you all days, even to the end of the world." (Matthew xxviii, 18-20). And on the very point of ascending into heaven from Mount Olivet, Jesus once again gave this solemn message to the same body of teachers: "Go ye to all the world; preach the Gospel to all creation. He that believeth and is baptized, shall be saved. He that believeth not, shall be damned." (Mark xvi, 15-16). The will of Jesus Christ, the divine Ambassador, is clear. He wishes all to belong to His Church. And yet no one is subject to the authority of the Church, unless he has entered it. And he enters the Church by faith; since faith is the root and foundation of justification. But true faith may not be forced. It must flow from the reason at the mandate of the unhampered, unshackled, free will.

Likewise, as our Constitution decrees, the State may not "prohibit the free exercise" of religion according to one's conscience; nor impose any obligation which runs counter to one's religious duty. It goes without saying that the rights of others must be protected. And the State may prevent such religious practices as interfere with these rights, and hinder the well-being of the community. This juridical status of the modern, constitutional State, as the protector of the religious rights of all, is the logical consequence of two fundamental facts in the science of sociology.

First, the State is not a divinely constituted depository of God's revelation to man. Hence it has neither the duty nor the right to dictate what its members shall believe, nor how they shall externally manifest their belief. Christ established a spiritual, and not a material society. He gave His doctrines to the Church, and not to the State, to hand down to men.

Pilate asked Him, "Art thou a king?" Jesus made reply: "My kingdom is not of this world." (John xviii, 33-36).

Secondly, the social organism or State is from God. Because man is by nature a social being. It is by the law of nature that men form themselves into an organic social unit. But whatsoever is by the law of nature, is from God the Author of nature. Therefore the social organism is from God. Therefore the unifying and vitalizing principle of that social organism is from God. But authority is the principle which unifies and vitalizes society. Hence the authority of the State is from God. Therefore civil authority is bound to protect God's rights in society. And one of those divine rights is to the reasonable manifestation, by the members of society, of their relations to the Supreme Author of the social organism.

No State has the right to be so godless and atheistic as utterly to rule God out. To rule God out of society were to do away with the very Author of society; to substitute the authority of might for the might of authority; to destroy the vitalizing principle of the State, and to devitalize, disintegrate and destroy the social organism.

4. Freedom of Worship, Guaranteed by Treaties.— Since the State, as to-day constituted, has the right and the duty to guarantee to its subjects that freedom of worship which is dictated by the certain conscience of each individual and does not clash with the rights of others, this same freedom may be the legitimate content of international treaties. The exigencies of diplomatic, business or other relations may render it necessary that the subjects of one State reside in another. They still have the natural right to worship God according to the dictate of a certain conscience. And their own State may protect that right. The treaty, whereby a State protects the religious freedom of its subjects abroad, is an agreement between two sovereign States; and essentially differs from a concordat. A concordat is a treaty between the Apostolic See of Rome and a State in diplomatic relations therewith; it has to do with the relations of the Catholic Church to the State. Before the Protestant reformation there was only one ecclesiastical authority in Christendom; and the religious rights of subjects were amply protected by the canonical relations between that supreme papal power and Christian states. Now such protection can no longer be guaranteed. Hence the necessity of treaties between sovereign states, which have as their object the guarantee of a freedom of divine worship. We instance some such treaties between the United States and other countries, which were generally made for the protection of Protestant missionaries. By a treaty of 1805, with the sultan of Tripoli, the American consul, his family and household, were guaranteed freedom of worship in the consulate. By the Treaty of Guadalupe, 1848, Mexico permitted Americans to practise and spread their religion within that republic. In 1856, Siam signed a treaty with the United States, whereby Americans were allowed to build churches and practise their faith in that kingdom. China, by the treaties of 1858 and 1868, yielded to Americans the right to build churches, maintain cemeteries and practise their religion in those parts where foreigners were permitted to reside. In 1858, Japan ceded to Americans freedom of worship and the right to build churches; and the United States in turn assured Japan against molestation of her subjects in their worship. The year following, 1859, our government secured by treaty the religious freedom of Americans, residing in Paraguay. In Turkey, American missionaries have been active since 1818. At first they shared in the religious freedom, which the Edict of Toleration has allowed to all Christians in the Ottoman empire since the 15th century. The treaties of 1830 and 1874 guaranteed to Americans the right to build churches, conduct mission schools and spread their religion throughout the Turkish empire.

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WORSTEDS, wŭst'ĕd or wûr'stĕd, are varieties of woolen yarn or thread, spun from long staple wool which has been combed, and which in the spinning is twisted harder than ordinary. It is knit or woven into stockings, carpets, etc. The name is derived from Worsted, a village in Norfolk, where it is supposed to have been first manufactured.

WORT, the saccharine liquid obtained by the action of malt on a mixture of water and crushed barley, corn or other grain, the whole being known as "mash." The water extracts

the maltose and dextrine from the malt and allows the diastase to act on the starch of the grain, changing it also to maltose and dextrine. The pectase of the malt at the same time changes the grain proteids to soluble peptones. Care must be taken of the temperature and the dilution of the mash in order to obtain the best results. Worts are of various kinds, depending on the grain used and the temperature given it. Some are fermented to beer, ale, porter and like beverages, while other forms are fermented to a mash that is distilled for alcohol or whisky.

WORTH, William Jenkins, American general: b. Hudson, Columbia County, N. Y., 1 March 1794; d. San Antonio, Tex., 7 May 1849. He received an ordinary education, and when the War of 1812 broke out enlisted as a private soldier, rising to the rank of captain in 1815. He was instructor of infantry tactics and commander of cadets at West Point 1820–28 and in 1838 became colonel of the 8th infantry. In 1840 he was sent to serve in the war against the Florida Indians, and in 1841 took the chief command. He was successful in repeated and severe conflicts with the aborigines, whereby the war was brought to a close, and in August 1842 was brevetted a brigadier-general for gallantry and distinguished services. In the war with Mexico, at the battle of Monterey, 23 Sept. 1846, he bore a very important part. As it was impossible to communicate with the commander-in-chief, Worth was obliged to act independently throughout the battle. He carried the forts commanding his line of approach, stormed the bishop's palace, and had fought his way through the streets nearly to the great plaza, when the town capitulated to Taylor, approaching from the other side. For these achievements Worth was brevetted a major-general, and received a sword from Congress. He was also distinguished at Cerro Gordo, Puebla, Cherubusco, Molino del Rey, and at the storming of the City of Mexico. A monument was erected to his memory by the city of New York, at Broadway and 25th street in 1858.

WORTH, William Scott, American general: b. Albany, N. Y., 6 Jan. 1840; d. Clifton, S. I., 16 Oct. 1904. Entering the Union army as 2d lieutenant in 1861, he became captain in 1866; lieutenant-colonel of the 13th infantry in 1894, and colonel in September 1898. He accompanied the army to Cuba, and during the assault on San Juan Hill, 1 July 1898, was severely wounded. He was promoted brigadier-general, United States army, in the following November, and was retired a week later.

WÖRTH, vĕrt, Alsace, village at the confluence of the Sauerbach and Sulzbach rivers 10 miles southwest of Weissenburg. It is celebrated as the place where the French under Marshal MacMahon on 6 Aug. 1870 met their first great defeat in the Franco-German War (q.v.).

WORTHEN, wĕr'thĕn, William Ezra, American civil engineer: b. Amesbury, Mass., 14 March 1819; d. New York, 2 April 1897. After graduation from Harvard in 1838 he began the practice of civil engineering, and until 1848 was employed chiefly with surveys connected with the Boston water supply, and in other hydraulic works. He designed and constructed several mills in Lowell, in 1849 began architectural work in New York, was made engineer of the New York and New Haven Railway, and in 1854 its vice-president. After 1854 he was busily employed as a practising and consulting engineer, being frequently retained as an expert in matters relating to the planning, construction or improvement of sewage and water systems. He was chief engineer of the first rapid transit commission of New York, and in 1890–91 chief engineer of the Chicago main drainage canal. In 1887 he was president of the American Society of Civil Engineers. Besides official reports, he published 'Cyclopædia of Drawing' (1857); 'First Lessons in Mechanics' (1862); and 'Rudimentary Drawing for Schools' (1863).

WORTHING, wĕr'thing, England, a watering place in Sussex, 12 miles west of Brighton, with good streets, handsome terraces, crescents, and villas, splendid hotels, baths, smooth sands, a beautiful esplanade, libraries, a literary institution, reading-rooms and assembly-rooms. Fruit-growing under glass is an important industry of the town. Pop. 30,305.

WORTHINGTON, Henry Rossiter, American inventor: b. New York, 17 Dec. 1817; d. Tarrytown, N. Y., 17 Dec. 1880. In 1840 he began a series of experiments with steam for the propulsion of canal boats, soon afterward devised a small steam pump to be used in the maintenance of the water supply in the engine boiler, and in 1841 patented an independent feed pump which developed into the direct-acting steam pump which he patented in 1849. Subsequently he built in Savannah, Ga., the first direct-acting compound-engine ever used in waterworks; invented the duplex pump, and devised various improvements in steam and hydraulic machinery.

WORTHINGTON, Minn., village, county-seat of Nobles County, on the Chicago, Rock Island and Pacific, and the Chicago, Milwaukee and Saint Paul railroads nearly 100 miles northeast of Sioux City, Ia. It is in an agricultural section and has flour mills, a grain elevator, stockyards and machine shops. The three banks have a combined capital of over $125,000. The village has a high school established in 1883, and a public library. Pop. about 2,385.

WOTHERSPOON, William Wallace, American military officer: b. Washington, 16 Nov. 1850. He entered upon a military career and was appointed an officer in the army in 1873. He first saw service in the Indian wars of that period, and later took an active part in both Mexican and Philippine wars, and during the latter campaign was collector of customs at the port of Iloilo in the Philippines. On his return to the United States in 1903, Wotherspoon was appointed assistant commandant of the army service schools at Fort Leavenworth, Kansas. Promoted to the general staff of the army (1909–10) he soon rose to the presidency of the Army War College (1910–12); and from April to November 1914 was chief of staff of the United States army. He retired with the rank of major-general, 16 Nov. 1914. In the following year he was appointed superintendent of public works of the State of New York.

WOTTON, wŏt'ŏn, **Sir Henry**, English diplomat and poet: b. Boughton Malherbe, Kent, 30 March 1568; d. Eton, December 1639. He was educated at Oxford, and having studied civil law under an eminent Italian professor, became proficient in the Italian language. He visited all the principal countries of the Continent 1589–97, and on his return was secretary to the Earl of Essex. On the fall of that nobleman he went to Florence, where he composed a treatise, printed after his death, entitled 'The State of Christendom.' The Grand Duke of Tuscany having intercepted some letters disclosing a plot to take away the life of James, king of Scotland, engaged Wotton to carry secret intelligence of it to that prince. This service he ably performed in the character of an Italian, and when James came to the English crown he sent for Wotton, knighted him and in 1604 employed him as an Ambassador to the Republic of Venice. As Wotton passed through Augsburg, being desired to write in an album, he wrote in Latin that "an ambassador is a good man, sent to lie abroad for the good of his country." This innocent sally was represented as a state maxim sanctioned by the religion of the king of England. James, who thought nothing relative either to kingcraft or state-craft a subject for wit, was highly displeased; and on his return Wotton had to make humble apology. At length he recovered the royal favor, and was restored to his former post at Venice (1616–19). Other missions followed, and in 1624 he was made provost of Eton College. The first-fruits of his leisure were his 'Elements of Architecture.' A collection of miscellanies was published after his death entitled 'Reliquiæ Wottonianæ.' This collection includes several poems by Wotton, of which two, 'The Character of a Happy Life' and 'On His Mistress, the Queen of Bohemia,' are among the finest lyrics in the English language. Consult 'Lives' by Izaak Walton (1651) and A. W. Ward (1899) and More, P. E., 'Shelburne Essays' (Fifth Series, New York 1908).

WOTTON, William, English scholar: b. Wrentham, Suffolk, 13 Aug. 1666; d. Buxted, Essex, 13 Feb. 1726. He had acquired a remarkable knowledge of Latin, Greek and Hebrew at the age of 10, was graduated at Saint John's College, Cambridge, in 1679, and was elected a Fellow there. He was later ordained, held various livings, and was a prebend of Salisbury Cathedral from 1705 until his death. He was prominent in the controversy concerning the respective merits of ancient and modern languages, taking the side of the moderns. He ably defended his views in 'Reflections Upon Ancient and Modern Learning' (1694, 1697), which was subjected to an attack by Swift in 'The Battle of the Books.' He was also author of 'History of Rome' (1701); 'Traditions and Usages of the Scribes and Pharisees' (1718), and he left an unpublished translation from the Celtic of the laws of Hywel Dda (1730).

WOUND, *in surgery*, a solution of continuity of any tissue or soft part of the body. Wounds are divided by writers on surgery into several kinds, the distinctions being founded either upon the sort of weapon with which the injury has been inflicted; upon the circumstance of a venomous matter having been introduced into the part; or upon the nature of the wounded parts themselves, and the particular situation of the wound. Hence we have cuts, incisions, or incised wounds, which are produced by sharp-edged instruments, and are generally free from all contusion and laceration. The fibres and texture of the wounded part have suffered no other injury but their mere division; and there is, consequently, less tendency to inflammation, suppuration, gangrene and other bad consequences than in the generality of other species of wounds. Another class of wounds are stabs or punctured wounds, made by the thrusts of pointed weapons, as bayonets, lances, swords, daggers, etc., and also by the accidental and forcible introduction of considerable thorns, nails, etc., into the flesh. These wounds frequently penetrate to a great depth so as to injure large blood-vessels, viscera and other organs of importance; and as they are generally inflicted with much violence the parts suffer more injury than would result from their simple division. Many instruments by which punctured wounds are made increase in diameter from the point, and when they penetrate far they force the fibres asunder like a wedge, and cause serious stretching and contusion. Bayonet wounds of the very soft parts are ordinarily followed by violent inflammation, tumefaction, large abscesses, fever, delirium, etc. A third description of wounds are the contused and lacerated, which strictly comprehend, together with a variety of cases produced by the violent application of hard, blunt, obtuse bodies to the soft parts, all those common injuries called gunshot wounds (q.v.). Many bites rank also as contused and lacerated wounds. In short, every solution of continuity which is suddenly produced in the soft parts by a blunt instrument or weapon which had neither a sharp point nor edge must be a contused, lacerated wound.

Poison wounds are those which are complicated with the introduction of a venomous matter or fluid into the part. Such are the stings and bites of a variety of insects, and the surgeon, in the dissection of putrid bodies, or in handling instruments infected with any venomous matter, is exposed to the danger of poisoned wounds from cuts. The most dangerous, however, of this class of wounds occur from the bites of the viper, the rattlesnake, etc., or from those of rabid animals. (See HYDROPHOBIA). Wounds may likewise be universally referred to two other general classes, the simple and complicated. A wound is called simple when it occurs in a healthy subject, has been produced by a clean, sharp-edged instrument, and is unattended with any serious symptoms. A wound, on the contrary, is said to be complicated when the state of the system, of the wounded part, or the wound itself, indicates the necessity for more complex treatment than the simple reunion of the cut surfaces. The differences of complicated wounds must, therefore, be very numerous, as they depend upon many incidental circumstances, the principal of which, however, are hemorrhage, nervous symptoms, contusion, the unfavorable shape of the injury, the discharge or extravasation of certain fluids, indicating the injury of particular bowels or vessels,

etc. All large or deep wounds are attended with more or less symptomatic fever, which usually comes on at a period varying from 16 to 36 hours after the infliction of the injury, and is generally of the inflammatory, but sometimes of an asthenic character. The liability to gangrene is also a formidable danger to be guarded against in the treatment of complex wounds.

In incised wounds the first thing to be attended to is to stop the hemorrhage. This is usually accomplished by simply bringing the edges of the wound together; but if any of the larger blood-vessels have been injured, pressing the trunk by means of a bandage or tourniquet will be necessary; and should this not succeed, the vessels must be secured with ligatures. Next, care should be taken that all extraneous substances are removed from the wound. Then the edges of the wound are to be brought together, and retained either by straps of adhesive plaster, or in some situations by one or two stitches. Generally such wounds heal very quickly, without any suppuration, "by first intention." When, however, this is not the case, and suppuration comes on, all attempts to procure union by first intention should be abandoned, the plasters and bandages removed, poultices and warm dressings used to remove inflammation, and afterward healing ointment applied. Lacerated and contused wounds require to be similarly treated; but they heal less kindly, and suppuration almost always takes place. The swelling and inflammatory symptoms which commonly attend contused wounds are to be diminished by cooling lotions or emollient poultices. Punctured wounds are dangerous from their depth; and the internal effusion of serum and blood which usually attends them. They are frequently also followed by severe inflammation and suppuration. The same general principles apply in this case, too. Sometimes it may be necessary to enlarge the wound a little, so as to remove the stretching of the parts, and to lessen the inflammation; leeches and fomentations are often required. In poisoned wounds free incisions, and even amputation may often be necessary. See GUNSHOT WOUNDS and consult Brewer, G. E., 'A Textbook of Surgery' (New York 1915); Groves, E. W. H., 'Gunshot Injuries of Bones' (London 1915); Penhollow, D. P., 'Military Surgery' (ib. 1916); Stevenson, W. F., 'Wounds in War' (New York 1898).

WOUNDS, War. See WAR WOUNDS.

WOUWERMAN, wow'vĕr-măn, **Philips,** a Dutch painter: b. Haarlem, May 1620; d. there, 19 May 1668. He was instructed by his father, an indifferent artist and by Wynants of Haarlem, in which city his life was passed. According to the commonly received account, his reputation as a painter during his life was small. After his death his pictures rose immensely in value, and he is now one of the most esteemed painters of the Dutch school. In consequence, it is said, of the disgust with which this neglect inspired him, he destroyed before his death all the studies he had made during his life, from fear that his son might be induced by the possession of them to become a painter. His subjects consist for the most part of roadside scenes and hunting or battle pieces, and it is commonly believed that he never painted a picture without a white or gray horse as a conspicuous object. His technical qualities are of a high order and his skies, foregrounds and foliage are executed in the best style of his school. He left upward of 800 carefully finished pictures. Those offered for sale always bring high prices, and in 1892 his 'Halt of a Sporting Party' was sold for $18,375. The best collection of his works is in the Royal Gallery of Dresden. There are also fine examples in the Louvre, and in Munich, Vienna, Petrograd, Amsterdam, The Hague, Rotterdam, etc. Consult De Groot, C. Hofstede, 'Catalogue Raisonné of the Works of the Most Eminent Dutch and Flemish Painters of the 17th Century' (new ed., 1909).

WOVEN FURNITURE. See WICKER WEAVING AND PRODUCTS.

WOVOKA (English name, JACK WILSON), Piute Indian prophet: b. Mason Valley, Nev., about 1856. He was left an orphan at the age of 14, and became a member of the family of David Wilson, a white man, from whom he received his English name. In 1888 or 1889, while in delirium from an illness he had what he described as a revelation to the Indians from the Great Spirit. He established himself as a prophet, foretelling the time when the old Indian life would be restored as it had been before the coming of the whites. Among the principles he put forth in his preaching were the equality of women in ceremonial affairs, the abolition of tribal warfare and the war dance, property distribution, and undue grief at funerals. He became most widely known among the various tribes by the institution of the Ghost Dance (q.v.) which the Indians generally adopted. The dance reached its greatest popularity in about a year's time after which, largely because of the Sioux outbreak (1890–91) and the action of the United States government, the excitement quickly subsided. Wovoka's influence waned to negligibility upon the failure of his prophecies. Consult Mooney, J., 'The Ghost Dance Religion' (1900).

WRANGEL, vrăng'ĕl, or **WRANGELL, Ferdinand Petrovitch,** BARON, Russian naval officer and explorer: b. Livonia, 9 Jan. 1795; d. Dorpat, 6 June 1870. He studied at the Naval Academy, Saint Petersburg and in 1820–24 directed a Polar expedition to explore the coast of eastern Siberia and the region north of Asiatic Russia. By sledge-journeys undertaken in 1822 and 1823 he reached lat. 72° 2′ N., but he found no trace of the reported land for which he was searching. This was discovered by G. W. De Long in 1867, and is now known as Wrangel Land, though taken possession for the United States as "New Columbia" by Hooper in 1881. In 1829–34 Wrangel was governor-general of Russian America, and in 1840–49 director of the Russian-American Company. He attained vice-admiral's rank in the navy. In 1855–58 he was acting Minister of Marine, and subsequently a Councillor of State. He opposed the sale of Russian America to the United States. His account of his Polar expedition appeared in Russian in 1844. An account in German was prepared from Wrangel's journals (1839), and of this an English translation was made by Sabine,

'Wrangell's Expedition to the Polar Sea' (1840). Consult Von Engelhardt, 'Ferdinand von Wrangel und seine Reise' (1885) and Sabine (ed.) 'Narrative of an Expedition to the Polar Sea in 1820–23' (London 1840).

WRANGEL, Karl Gustaf von, COUNT, Swedish general: b. Skokloster, on Lake Maelar, 13 Dec. 1613; d. Isle of Rugen, 24 June 1676. He accompanied Gustavus Adolphus in his expedition to Germany, and at the battle of Lützen, in 1632, rendered great services after the fall of the king. In 1641 he was one of the major-generals who commanded the Swedish forces until the arrival of Torstenson, and under him participated in the campaign in Germany, and the famous march of Holstein. After the death of Flemming in 1644 he received the supreme command of the Swedish fleet, and obtained over the Danish fleet a great naval victory on 13 October, between the islands of Femern and Laaland. In 1646 he succeeded Torstenson as commander-in-chief of the Swedish army, effected a junction at Geissen with the French forces under Turenne, with whom he crossed the Main and besieged Augsburg, which, however, was relieved by the Austrian army. In 1648 the Swedes and French defeated the Austrians and Bavarians near Zusmarshen, but retured before the army of Piccolomini. Wrangel commanded under Charles X in the campaigns in Poland (1655) and Denmark (1657–59), and in 1674 led an army of 16,000 men into the electorate of Brandenburg. Ill health obliged him to relinquish this command before the conclusion of the campaign.

WRANGEL (răng'gĕl) **LAND,** or **NEW COLUMBIA,** an island in lat. 71° 32″ N., and long. 178° W.; in the Arctic Ocean, about 100 miles off the coast of Siberia and 300 miles from the coast of Alaska. It is about 75 miles long and 20 miles wide. It consists chiefly of bare rocks which rise to a height of 2,000 feet. At the base and in places near the shore line there is some vegetation. The first mention of an island in this locality was made about 1810, and in 1821 Ferdinand Baron Wrangel, the Russian explorer, commanded an expedition in search of this land. Long, the American explorer, sighted the island in 1867, and Hooper, also an American, visited it in 1881, and took possession of it for the United States. He named the island New Columbia. Consult Hooper, Rosse, Muir and Nelson, 'Cruise of the Corwin' (Washington 1893).

WRANGELL, Alaska, village, on Wrangell Island, near the mouth of the Stikine River, about 170 miles southeast of Juneau, and 120 southeast of Sitka. A settlement was made here by Russians in 1833. It is a trading post for fish and furs. It has a hatchery, salmon canneries and storehouses. It was long important as a distributing centre for mining camps and interior trading posts. There is steamship communication with Seattle and the town has a government school for natives. It contains also a wireless station. Pop. about 800.

WRANGLER, Senior, a term applied previous to 1909 in the University of Cambridge, England, to the undergraduate who passed the best public mathematical examination for the bachelor's degree. The candidates for honors were arranged in order of merit in three lists or classes, of which the highest was called that of wranglers, the next that of senior optimés, and the lowest that of junior optimés — the whole constituting what was known as the mathematical tripos. Hence the senior wrangler or the highest in the list of wranglers was the most distinguished mathematician of the year. Since 1909 the results of the examination have been published with the names in alphabetical order.

WRASSE, a fish of the family *Labridæ* (q.v.), of which the best known representatives in America are cunners, doncellas, ladyfishes, tautogs, etc.

WRATTISLAW, răt'ĭs-lâ, **Arthur Henry,** English scholar: b. England, of Bohemian parentage, about 1822; d. 1892. He was graduated from Cambridge in 1844, was headmaster of Felstead Grammar School 1849–57, and of that at Bury Saint Edmonds 1857–79, and was vicar of Manorbier, Pembrokeshire, Wales, 1879–87. He was the leading Slavonic scholar of his day in England, and among his important publications are 'Lyro Czecho-Slavonska' (1849); 'The Queen's Court MSS. with Other Ancient Bohemian Poems' (1852); 'Life, Legend and Canonization of Saint John Nepomuk' (1873); 'Native Literature of Bohemia in the 14th Century' (1878); 'Sixty Folk Tales from Exclusively Slavonic Sources' (1889).

WRAXALL, răk'săl, SIR **Nathaniel William,** English historian: b. Bristol, 8 April 1751; d. Dover, Kent, 7 Nov. 1831. He was in the East Indian Civil Service, 1769–72, and during the course of some seven years of foreign travel was a confidential agent of Queen Caroline Matilda of Denmark to her brother, George III (1774–75). He published 'Cursory Remarks Made in a Tour' (1775); 'Memoirs of the Valois Kings' (1777); 'History of France from Henry III to Louis XIV' (1795); 'Memoirs of the Courts of Berlin, Dresden, Warsaw, and Vienna' (1799), and the famous 'Historical Memoirs of My Own Time, from 1772 to 1784' (1815). For a libel in the last on Count Woronzov, Russian envoy to England, Wraxall was fined $2,500 and sentenced to six months' imprisonment. He is an amusing writer, but his veracity has been many times questioned. He sat in Parliament for 14 years from 1780 and was knighted in 1813. Consult his 'Posthumous Memoirs,' continued from 1784 to 1790 (1836).

WRAY, John. See RAY, JOHN.

WRECK, that which is cast or driven ashore by the waves, the goods, broken timbers, plates, etc., cast ashore from a ship that has been broken up, destroyed or rendered helpless at sea, as by collision, tempest, etc. In maritime law the term means the goods cast ashore by the waves after shipwreck, and left there within the jurisdiction of some country, and subject to common law. A ship also is a wreck when she is rendered unable to pursue her voyages without repairs exceeding half her value. A sunken vessel is not a wreck, but a derelict. In the United States laws have been enacted by the several States bordering on the sea and on the Great Lakes for the safe-keep-

ing and proper disposition of wreck. Goods found at low-water mark, or between high- and low-water mark, whether resting or partly resting on the ground, are wrecks, and, if not reclaimed, belong to the owner of the shore. See SALVAGE; MARINE INSURANCE.

WRECKAGE, *in navigation,* is usually understood to mean any ship or goods driven ashore or found floating at sea in a deserted or unmanageable condition. *In law,* wreckage is defined as such articles of value as are cast upon land by the sea, and includes jetsam, flotsam, ligan and derelict. In most countries any person found stealing or destroying any wreck is chargeable with felony; and a person proved to be in possession of shipwrecked goods, or who offers such goods for sale, may be fined or imprisoned. See WRECK.

WREN, rĕn, SIR **Christopher,** English architect: b. East Knoyle, Wiltshire, 20 Oct. 1632; d. Hampton Court, Berkshire, 25 Feb. 1723. He entered as a student at Wadham College, Oxford, in 1646, having previously given proofs of genius by the invention of astronomical and pneumatic instruments. In 1647 he wrote a treatise on spherical trigonometry upon a new plan, and the following year composed an algebraical tract on the Julian period. He was one of the earliest members of the Philosophical Society at Oxford, which was the origin of the Royal Society, after the institution of which, in 1663, he was elected a Fellow and distinguished himself by his activity in promoting the objects of that institution. In 1657 he was appointed professor of astronomy at Gresham College, but, being nominated to the Savilian professorship of astronomy at Oxford, resigned the former office, and in 1661 returned to the university. He received a commission in 1663 to prepare designs for the restoration of Saint Paul's Cathedral, then the largest Gothic edifice in the kingdom. While his designs were under consideration the cathedral was destroyed by the fire of 1666, and Wren had now an opportunity for signalizing his talents by the erection of an entirely new structure. In 1668 he succeeded to the office of surveyor of works, resigned his Savilian professorship in 1673, in 1674 received the honor of knighthood; and in the following year the foundation of the new cathedral was laid. In 1680 he was chosen president of the Royal Society. In 1683 he was appointed architect and one of the commissioners of Chelsea College; and the following year controller of the works at Windsor Castle. He was elected member of Parliament for Plympton in 1685, and to his public trusts were added in 1698 that of commissioner for the repair of Westminster Abbey, and in 1699 that of architect of Greenwich Hospital. In 1700 he represented in Parliament the boroughs of Weymouth and Melcombe Regis. In 1708 he was made one of the commissioners for the erection of 50 new churches in and near the city of London. After having long been the highest ornament of his profession he was, in 1714, deprived of the surveyorship of the royal works from political motives. He was then in the 85th year of his life, the remainder of which was devoted to scientific pursuits and the study of the Scriptures. His remains were interred under the choir of Saint Paul's Cathedral, and over the choir entrance was placed the following inscription (since removed to another part of the church):

Subtus conditur
Hujus Ecclesiæ et Urbis Conditor,
Christ. Wren;
Qui vixit Annos ultra nonaginta.
Non sibi sed Bono publico.
Lector, si Monumentum quæris,
Circumspice.

(Beneath is laid the builder of the church and city, who lived above ninety years, not for himself but for the public good. Reader, if thou seekest his monument, look around).

The edifices constructed by Wren were principally public, including a royal hunting seat at Winchester and the modern part of the palace at Hampton Court. Some of the most remarkable of his buildings, besides Saint Paul's, are the monument on Fish Street Hill, the theatre at Oxford, the library at Trinity College, Cambridge; the hospitals of Chelsea and Greenwich; the church of Saint Stephen's, Walbrook; those of Saint Mary-le-Bow, Saint Michael, Cornhill and Saint Bridge, Fleet street; and the great campanile of Christ Church, Oxford. The Royal Exchange and Custom-house, since destroyed by fire and re-erected, were among his works. As an architect he possessed an inexhaustible fertility of invention combined with good natural taste and profound knowledge of the principles of his art. His talents were particularly adapted to ecclesiastical architecture, but in his palaces and private houses he sometimes achieved monotonous results, as at Hampton Court. The interior of the church of Saint Stephen's, Walbrook, which has been considered as his *chefd'œuvre,* exhibits a deviation from common forms equally ingenious and beautiful, and Saint Paul's Cathedral may be fairly reckoned among the most magnificent productions of architectural genius. Yet the works of Wren have not passed without censure. Even in Saint Paul's, while the grandeur of the whole work is admitted, many faults, and especially waste of interior space, are charged against him. Consult 'Parentalia, or Memoirs of the Family of the Wrens' (1750); Elmes, 'Sir Christopher Wren and His Times' (London 1823); Clayton, 'Churches of Sir Christopher Wren' (London 1848); Milman, 'Annals of Saint Paul's Cathedral' (1868); 'Life,' by Phillimore (1883); Loftie, 'Inigo Jones and Wren' (New York 1893); Marshall, 'Under the Dome of Saint Paul's' (1899); Dimock, 'Handbook of Saint Paul's Cathedral' (1900).

WREN, a family (*Troglodytidæ*) of passerine birds, having a slender, slightly curved and pointed bill, with the exposed nostrils partly concealed by a scale, the wings very short and rounded, with nine well developed and the first short primaries, the tail short and often carried erect; the legs are robust and rather long. They are abundant in the neotropical region, less common in the nearctic, and only a few occur in the Old World in Europe, Asia and Sumatra, those of the latter region being more or less aberrant. The known species exceed 100 and are arranged in about 15 genera, several of which are confined to tropical America. North America has six genera and 14 species. Closely related to the wrens are the mocking thrushes, which some ornithologists place in the same family, and the creepers (*Certhiidæ*). The wrens are plain little birds

On beginning, the wrestlers take hold from the head and not lower than the waist, when both roll on the ground, and then the actual struggle begins. Tripping, which is the very essence of the game, is not allowed; therefore weight and strength are the only factors in the contest, which terminates when one of the combatants has been placed on both shoulders. Wrestling has recently become popular in Japan and India. The Japanese have adopted the Græco-Roman style and receive handsome rewards at the conclusion of their contests. The Jap wrestlers, who are a most formidable class of men, before entering the arena adorn themselves with a certain kind of paint, with a huge belt round the waist and their enormous calves encased in stout leggings. The Indians, on the other hand, wrestle in bathing costume, and in a match only contest one bout, and one shoulder on the ground is deemed a fall. Consult Cann, W. E., 'Manual of Wrestling' (Battle Creek, Mich., 1912).

WREXHAM, rĕks'ăm, North Wales, a market-town in the county of Denbigh, 12 miles south of Chester, in a district containing coal, lead and iron. It is a station on the Great Western and Great Central railways, 201 miles from London, and has several churches and other places of worship, schools, a guildhall, infirmary, barracks, market-halls, public baths, electrical works, a free library, etc. The restored parish church, dedicated to Saint Giles, was erected in the reign of Henry VIII. There are in the town large breweries, tanneries, paper mills, etc. It is the seat of a Roman Catholic bishopric. In Saint Giles' churchyard is the tomb of Elihu Yale, founder of Yale College, New Haven, Conn., U. S. A. Pop. 18,377.

WRIGHT, Adam Henry, Canadian physician: b. Brampton, Ontario, 1846. He was graduated at Toronto University in 1866, took the degree of M.D. there in 1873, and later studied in Europe. He taught in the Toronto School of Medicine in 1879–87; was associated with the staffs of the Toronto General Hospital and the Women's Medical College; was professor of obstetrics at Toronto University in 1887–1912, and has since been professor emeritus. Since 1911 he has been chairman of the provincial board of health of Ontario. He wrote 'A Text Book of Obstetrics' (1905).

WRIGHT, Arthur Williams, American physicist: b. Lebanon, Conn., 8 Sept. 1836; d. 19 Dec. 1915. He was graduated from Yale in 1859, studied law and was admitted to the bar, but did not practise, and was a tutor in Latin at Yale 1863–66, and in physics 1866–68. He afterward studied at Heidelberg and Berlin, was professor of physics and chemistry at Williams College 1869–72; of molecular physics and chemistry at Yale 1875–87, and of experimental physics there from 1887–1906. From 1885 he has been in charge of the Sloane physical laboratory at Yale. He has published numerous professional papers, is a Fellow of the Royal Astronomical Society of Great Britain, and a member of various other learned societies. He has also published a 'History of the Class of 1859 of Yale College' (1914).

WRIGHT, Carroll Davidson, American statistician and sociologist: b. Dunbarton, N. H., 28 July 1840; d. Worcester, Mass., 20 Feb. 1909. After studying law, he enlisted in the 14th New Hampshire volunteers at the outbreak of the Civil War, and in 1864 became its colonel. In 1865 he was admitted to the bar at Keene, N. H., in 1867 began practice at Boston, in 1872–73 was a member of the Massachusetts senate, and in 1873–88 chief of the Massachusetts Bureau of Labor Statistics. He was appointed national commissioner of labor in 1885, and he continued in this office for some time after his election as president of the collegiate department of Clark University (Worcester, Mass.) in 1902. In 1895 he became honorary professor of social economics in the Columbian University (now George Washington), and delivered lectures in numerous institutions. He was chosen president of the American Statistical Association, in 1902 chairman of the section on social and economic science in the American Association for the Advancement of Science and vice-president of the association, and in 1903 president. He was recorder of the commission appointed by the President to arbitrate in connection with the anthracite coal strike in the fall of 1902. In 1906 the order of Saints Maurizio e Lazzaro was conferred upon him by the king of Italy in recognition of his services as political economist. Besides numerous contributions to periodicals, he has published 'The Industrial Evolution of the United States' (1895); 'Outlines of Practical Sociology' (1899); 'Some Ethical Phases of the Labor Question' (1902); 'Battles of Labor' (1906); 'The Apprenticeship System in its Relation to Industrial Education' (1908). Consult Wadlin, H. G., 'Carroll Davidson Wright: a Memorial' (Boston 1911).

WRIGHT, Charles Henry Hamilton, Irish Anglican clergyman: b. Dublin, 9 March 1836; d. 1909. He was graduated from Trinity College, Dublin, in 1857, was Bampton lecturer at Oxford in 1878, Donnellan lecturer at Dublin 1880, Grinfield lecturer on the Septuagint at Oxford 1893–97, and vicar of Saint John's, Liverpool, 1891–98, examiner in Hebrew at the University of London 1897–99, at the University of Wales 1897–1901, and clerical superintendent of the Protestant Reform Society in 1898–1907. Among his numerous publications are 'Grammar of Modern Irish' (1855; ed. 1860); 'Book of Genesis in Hebrew' (1859); 'Bunyan's Works with Notes' (1866); 'Fragments and Specimens of Early Latin' (1874); 'The One Religion' (1881); 'Biblical Essays' (1885); 'Roman Catholicism in the Light of Scripture' (2d ed., 1897); 'The Intermediate State and Prayers for the Dead' (1900); 'Genuine Writings of Saint Patrick with Life' (1902); Daniel and his Prophecies' (1906).

WRIGHT, Elizur, American abolitionist, b. South Canaan, Conn., 12 Feb. 1804; d. Medford, Mass., 21 Nov. 1885. He was graduated at Yale in 1826, was professor of mathematics in Western Reserve College in 1829–33, and became identified with the anti-slavery movement in the last-named year. He then removed to New York, where he edited *Human Rights* (1834–35), and the *Quarterly Anti-Slavery Magazine* (1837–38), and was at the same time secretary of the Anti-Slavery Society. Removing to Boston in 1838 he there edited the

(a book on New England birds, 1895); 'Tommy-Anne: A Natural History Story' (1896); 'Citizen Bird' (with Dr. Coves, a book for beginners, 1897); 'The Dream Fox Story Book' (1900); 'The Flowers and Ferns in Their Haunts' (1901); 'Dogtown' (1902); 'The Garden, You and I' (1906); 'Gray Lady and the Birds' (1907); 'Princess Flower Hat' (1910); 'The Stranger at the Gate' (1913); 'The Hymn of the Flag' (soldier marching song, 1917); 'Captain of the Watch' (1918).

WRIGHT, Marcus Joseph, American soldier, brother of J. V. Wright (q.v.): b. Purdy, Tenn., 5 June 1831. He studied law, was admitted to the bar and practised his profession in Memphis till the outbreak of the Civil War, when he entered the Confederate army as lieutenant-colonel of the 154th Tennessee regiment. He was promoted brigadier-general in 1862, and was wounded at Shiloh. He has written 'Life of Gen. Winfield Scott' in 'Great Commander' series (1894); 'Life of Governor William Blount'; 'History of McNairy County, Tenn.'; 'Sketch of the Life of the Duke of Kent'; 'The Social Evolution of Woman'; Sketches of Confederate generals in Appleton's 'Cyclopedia of American Biography.' In addition he was also co-editor of 'Memoirs of Robert E. Lee' (with Gen. A. L. Long, 1886); 'Library of American History' (1900); 'General Officers of the Confederate Army'; 'Colonel David Crockett of Tennessee'; 'Life of Gen. John Peter Muhlenberg'; 'Tennessee in the War of 1861-65.' In 1878 he was selected by the Department of War as agent for the collection of Confederate records for the United States government.

WRIGHT, Mary Tappan, American novelist: b. Steubenville, Ohio, December 1851; d. 1917. She was a daughter of Eli Tappan, a president of Kenyon College, and in 1879 was married to John Henry Wright (q.v.). Her work in fiction which displays much keen characterization and charm of style, includes 'A Truce and Other Stories' (1895); 'Aliens' (1902); 'The Test' (1904); 'The Tower' (1906); 'Charioteers' (1912).

WRIGHT, Orville, American aviator and inventor: b. Dayton, Ohio, 19 Aug. 1871. He was educated in public and high schools until 1888. He became interested in kites and gliding machines and did much experimental work, together with his brother Wilbur (q.v.). From 1903 he devoted his attention mainly to developing a biplane. The first test was made at Kittyhawk, N. C., in 1903, and the first successful long distance test took place near Dayton, Ohio, in 1905. He afterward made numerous flights in the United States and abroad. He was awarded a gold medal by the French Academy of Sciences in 1909. He received the honorary degree of B.S. from Earlham College in 1909, and LL.D. from Oberlin College in 1910. In 1915 he sold his holdings in the Wright Aeroplane Company of Dayton.

WRIGHT, Robert Ramsay, Canadian biologist and educator: b. Alloa, Scotland, 23 Sept. 1852. He was graduated at Edinburgh University in 1873, removed to Canada in 1874, and in that year was appointed professor of natural history at University College, Toronto. He was professor of biology at the University of Toronto in 1887-1912, and in 1901-12 he was also vice-president of the university and dean of the faculty of arts. Since 1912 he has been professor emeritus of biology. He was assistant director of the biological station of Canada after 1901. He served at different times as president of the Canadian Institute, the American Association of Anatomists and of the Royal Society of Canada.

WRIGHT, Silas, American statesman: b. Amherst, Mass., 24 May 1795; d. Canton, N. Y., 27 Aug. 1847. He was graduated at Middlebury College, Vermont, in 1815, studied law, was admitted to the bar in 1819, and established himself as an attorney at Canton, N. Y. In 1823 he entered the State senate, where he steadily opposed the political advancement of De Witt Clinton, which he regarded as dangerous to the Democratic party, of which throughout his life he was a firm adherent. He sat in Congress 1827-29, and there advocated and voted for the protective tariff of 1828. He also voted for the appointment of a committee to enquire into the expediency of abolishing slavery and the slave trade in the District of Columbia. He was comptroller of New York 1829-33, and a United States senator 1833-44. He supported Clay's compromise bill in 1833; voted against receiving a petition for abolishing slavery in the District of Columbia, and in favor of excluding from the mails all "printed matter calculated to excite the prejudices of the Southern States in regard to the question of slavery," voted for the tariff of 1842, though most of his political associates in the Senate voted against it; and voted for the annexation of Texas to the Union. In 1844, against his will, he was nominated by his party to be governor of New York, and was elected. President Polk offered him the office of Secretary of the Treasury in 1845, but he declined it, as he had previously declined a seat on the Supreme Court bench. As governor he vetoed a bill appropriating money for works on the canals, on the ground that the effect of the bill was to resume the enlargement of the canals which had been suspended by law in 1842, out of regard for the financial safety of the State. recommended legislation against the anti-renters, and on occasion of disturbances produced by them in Delaware County in 1845 proclaimed the county to be in a state of insurrection and called out a military force. Nominated for re-election in 1846, he was defeated by the Whig candidate. When the application of the Wilmot proviso to the territories obtained from Mexico was under discussion, Wright emphatically declared that the arms and the money of the Union ought never to be used to acquire territory then free for the purpose of planting slavery upon it. On the expiration of his term as governor he returned to his farm at Canton. Consult 'Lives' by Jenkins (Auburn 1847); Hammond (Syracuse 1848); Gillet (Albany 1874).

WRIGHT, Thomas, English antiquary: b. Tenbury, Shropshire, 23 April 1810; d. Chelsea, London, 23 Dec. 1877. He was graduated at Trinity College, Cambridge, settled in London, and devoted himself to the study of English history, literature and antiquities. He was one of the founders of the Camden Society, and of the British Archæological Association,

battery and White's battalion of cavalry, marching through York, appeared before Frick's position on the evening of 28 June and began skirmishing, under cover of which Gordon endeavored to cut him off from the bridge by a flank movement, but failed, and then opened fire with Tanner's artillery, to which Frick could not reply, being without guns. His rear threatened, Frick retreated across the bridge and fired it, leaving 18 or 20 prisoners in Gordon's hands. Gordon attempted to follow, but was checked by the flames. The bridge was totally destroyed and the flames communicated to the town of Wrightsville, consuming several buildings, but the further progress was arrested by Gordon's men. The destruction of the bridge was a keen disappointment to Early, who had hoped to cross it and attack Harrisburg from the east side of the river. On the 29th Gordon marched back to York.

WRIT. In general understanding a writ is a mandatory precept issued by the authority of and in the name of the executive branch of the State for the purpose of compelling the defendant to do some particular thing mentioned in the instrument. Writs are generally classified as mandamus, habeas corpus, summons, error, quo warranto, certiorari or review. Writs are further distinguished as original and judicial. Original issued without any order of the court in the particular case, judicial issued in pursuance of a decree or order or judgment of the court. A writ of mandamus is a command issuing from a court of law of competent jurisdiction, in the name of the State, directed to some inferior court, officer, corporation or person, requiring them to do some particular thing therein specified, and which appertains to their office or duty. In order to secure a writ of mandamus it is necessary to show (1) that the petitioner has a legal right to have the thing done which it is sought to be done; (2) that it is the duty of the respondent to perform it; (3) that the writ is the only plain, speedy and adequate remedy. A writ has a purely personal effect. An injunction — either mandatory or prohibitory — is a writ framed according to the circumstances of the case commanding an act which the court regards as essential to justice or restraining an act which it esteems contrary to equity and good conscience. Quo warranto is an order to show by what authority a given act is done or office held. A writ of error is a commission to a superior court by which they are authorized to examine the record in a case on which judgment has been given in an inferior court. Habeas corpus is an order issued by a magistrate to an officer in charge of the person of the defendant and designed to give summary relief against illegal restraint of personal liberty. Summons is a demand made to a person to appear at a given time before a court or officer. Certiorari or review is an order to a superior court to review the evidence presented before an inferior court. Consult Blackstone, 'Commentaries on the Laws of England'; Hallam, 'Constitutional History' (New York 1872); Hurd, 'On the Right of Personal Liberty' and 'On the Writ of Habeas Corpus' (2d ed., Albany 1876); Pollock and Maitland, 'History of the English Law' (2d ed., Boston 1899).

WRITERS' CRAMP, or SCRIVENERS' CRAMP, or PALSY, an occupation-neurosis to which those who do much writing, especially with the hand too tightly contracted, are very liable. A person with this trouble has no complete control over the muscles of the thumb and middle and forefingers, brought into use in writing, although other manual operations are performed without difficulty. The affection seldom manifests itself until toward middle age. The various methods of treatment that have been proposed have not been very successful. Small surgical operations have been performed with occasional but far from general good results. The application of electricity to the adductor of the thumb, and the kneading of the muscles of the ball of the thumb and the lower part of the forearm, so as to promote the circulation in those parts, are said to be beneficial, but the only way to obtain perfect relief is for the patient to abstain from writing altogether. If he is obliged to write he will do so with more ease if he uses a pen with a very thick handle. For extreme cases several contrivances have been devised for assisting the patient to write by altering the movements of the fingers in writing, and giving support to the ball of the hand. The typewriter has proved the best resource of those who suffer from the ailment. See NEUROSIS.

WRITERS TO THE SIGNET, in Scotland, where lawyers generally are called writers, an incorporated legal society dating from an early period of Scottish history. Originally, the name probably applied to clerks in the office of the Secretary of State, where was deposited the seal by which the king's letters and writs for the purposes of justice were authenticated. This duty was monopolized by this close society of practitioners, members being appointed, not by public officials, but by the organization. Thus the Writers to the Signet came to control admissions to the bar, like the English Inns of Court. They still retain a certain prestige at the bar, but their former monopoly has been taken away by recent statutes.

WRITING, the art of recording ideas by means of characters or figures of some sort impressed upon some kind of material substance. History, though it does not throw complete light on the origin of writing, suffices to show certain stages in its progress, and upon these a classification has been founded, which is, however, incomplete and unsatisfactory. The simplest classification and perhaps at an initiatory stage the best, is that which divides all writing into ideographic and phonographic or signs representing the things symbolized by words and signs representing sounds, that is words themselves. Less satisfactory is the classification of writing into three historical stages, the figurative, the transitional or conventional, and the alphabetic. In the first of these, to which hieroglyphic writing belongs, writing is supposed to be pictorial or immediately representative of objects. After this, in the transitional period comes symbolical writing, in which abbreviated pictures are transformed into arbitrary symbols, first of things and afterward of sounds and words. Lastly, with the prevalence of phonetic writing sounds are represented first in syllables and afterward in

letters. The course of writing is generally in the direction thus indicated, but it is inaccurate and misleading to represent these stages as epochs in its progress. As the most modern writing contains traces of the first of these methods, so the earliest contains traces of the last. The majority of the letters in modern alphabets can be traced to symbols or abbreviated pictures representative of things, but as the thing originally represented is usually an object whose name begins with the sound represented by the letter, there is no evidence that the sign was not originally intended in a double sense and used as a phonograph. In Egyptian hieroglyphics we have ideographs and phonographs mixed together. This, however, does not prove the absolute precedence of ideographs, but only the imperfection of the phonographic elements in that system. The same thing occurs in the Mexican picture writing, which was long supposed to be purely ideographic. Its phonetic signs are syllabic, not alphabetic. In our own system we use figures and other symbols when phonographic signs are too slow for our purpose, and with a less perfect phonographic system this would naturally occur much more frequently. It does not appear, moreover, that any transition from pictorial to phonetic writing is necessary through arbitrary non-phonetical symbols. Both of these modifications would no doubt proceed simultaneously from independent causes. Pictorial signs not phonetized would be abbreviated as well as phonetized signs, and when the phonetized abbreviations came to prevail the non-phonetized abbreviations would be phonetized also, thus producing the appearance of a transition from arbitrary symbols to phonetic signs.

The reason why writing has had to pass through various stages of pictorial and more or less arbitrary symbolical representation before reaching the more perfect development of the alphabetic form is not very difficult to discover, and it has an important bearing on the order of development. It is not because the representation of words is in itself more difficult to conceive than the representation of things, or because when the desire for writing as a medium of communication is excited the human intellect is inadequate to the task of forming at once an entire phonetic system. Had phonetic or even alphabetic representation been the only possible means of constructing a written symbol all difficulties would doubtless have been overcome by one sustained effort, as they have actually been by many partial ones; but as an easier process was to be found and would directly suggest itself as a means of meeting the immediate demand, the more elaborate process was excluded and prevented by this process from being performed. Nothing is easier than to make a rude pictorial representation of certain objects. To draw something resembling a man would be easier than to agree on a sign to represent the word man, hence ideographs would naturally precede phonetic symbols. But for the same reason the earliest systems of writing would not be purely ideographic but mixed. There are many things which form the subject of the least sophisticated human communications which cannot be represented pictorially. When writing was first practised these things were already represented by words, and the idea would naturally occur to form a sign to represent the word, that is, a phonetic sign. These signs could not be directly pictorial, but they might be allegorical or symbolic, and in the absence of analysis of sound they probably would take that form, although the direct intention was to suggest conventionally a specific word by the symbol. This sort of symbol might be called a mnemonic. From such symbols to merely arbitrary syllabic and alphabetic symbols the transition would be easy.

It is generally agreed that writing was introduced to the western nations by the Phœnicians, and it is commonly believed that the Phœnician system was based on the Egyptian but the comparative antiquity of the Egyptian and Assyrian or Akkadian, the hieroglyphic and cuneiform systems, cannot be definitely determined. The Egyptians attributed their writing to Thoth, and the first characters are said to have consisted of portraits of the gods. The cuneiform writing, which is cumbrous and exceedingly difficult to read, has been adapted to several languages, the Akkadian, the Assyrian, the Persian, etc., in a variety of ways, ideographic, syllabic and alphabetic. The Egyptians had three distinct kinds of writing, the hieroglyphic, the hieratic and the enchorial or demotic. The first is a mixed system, containing large numbers of signs of various characters, ideographic and phonetic. It is used chiefly for inscriptions on monuments and public buildings. The hieratic is a cursive hand abridged from the hieroglyphic for use on papyri. Both these forms were sacred, and the priestly caste only were initiated in them. The demotic was introduced much later than the other forms. It was used for trading and common purposes, and in civil documents. The hieratic writing was more phonetic than the hieroglyphic, and the alphabetic character prevailed in the demotic. The first was written in any direction according to the form of the surface; the hieratic was at first written in columns, but afterward always in horizontal lines. The hieratic and demotic are read from right to left, but the individual letters are formed from left to right. The connection between the Egyptian and the Semitic writings, to which the Phœnician belongs, is by no means unanimously admitted, many scholars holding that the resemblances between them may be explained by the independent adoption of common principles. The leading Semitic forms are the Samaritan or ancient Hebrew, the Chaldee or East Aramaic, the Syriac or West Aramaic, and the Kufic or early Arabic, which continued to be used in manuscript for several centuries after the Mohammedan conquest, after which it was replaced by the Neshki or modern Arabic, which, with some slight modifications, is the same with the modern Persian. The Hebrew alphabet now in use, the Babylonian or East Aramaic, is entirely consonantal, the vowel points being of modern origin. The Phœnician which forms the basis of the western languages was of a similar character. Phœnician writing was anciently represented to have been brought by a Cadmean colony to Bœotia about the 16th century B.C. (see CADMUS); and a certain number of the Greek letters are undoubtedly of Phœnician origin. (See the section on language and writing in the article GREECE). The

Greeks at first wrote from right to left, and afterward adopted the method called *boustrophēdon*, from the motion of the ox in plowing, that is, alternately from right to left, and from left to right. Writing from left to right was said to have been introduced in the time of Homer by Pronapides of Athens. The various modifications which the Phœnician or Pelasgian forms underwent in Italy are to be found by comparison of the Oscan, Etruscan, Umbrian and early Latin inscriptions. In the ancient Greek and Roman writing, and even for a time in the mediæval writing of Europe, the words were not separated by spaces, and no punctuation marks were used. The present cursive characters with modifications occur in Greek inscriptions of the age of Augustus. In mediæval manuscripts a variety of styles were adopted in different epochs and countries and for different uses, to describe which in detail would require a separate treatise. In France the various styles were called after the dynasties under which they prevailed: Merovingian, Carlovingian, Capetian, Valesian and Bourbon. There were also a variety of styles used for different purposes distinguished by such names as *majuscule* and *minuscule* (great and small letters), diplomatic minuscule and many others. Capitals were not then used as now to distinguish prominent words, but whole manuscripts were written in large or small capitals. There were also a variety of mixed styles. From the 8th to the 11th centuries writing with *tremblements* was affected in France. The diplomatic minuscule was a mixture of minuscule and cursive characters distinguished by an unusual prolongation of the long letters. Uncial letters, which prevailed from the 7th to the 10th centuries, were rounded capitals with few hair-strokes. The practice of ornamenting pages began in the 8th century, and the earliest manuscripts are also without title pages. The so-called Gothic characters, in reality of scholastic origin, are merely fanciful deviations from the Roman types, such as the rounding of straight limbs, the substitution of angular facets for rounded forms, with hair-lined projections from the extremities contrasting with massive body-strokes. They became common in inscriptions from the 13th to the 15th centuries, and were employed in church-books from the time of Saint Louis. The Gothic cursive was introduced about the middle of the 13th century. The modern German alphabet was also introduced in the 13th century. In England a variety of styles called Saxon prevailed in the early Middle Ages. An elegant mixed style was formed of a combination of Roman Lombardic and Saxon characters. The Norman style of writing came in with William the Conqueror. The old English form of Gothic dates from the middle of the 14th century. The English "court hand," an adaptation of Saxon, prevailed from the 16th century to the reign of George II. In regard to the antiquity of writing in other parts of Europe, it was known to the Gauls before the time of Cæsar; but no traces of the ancient writing remain, and whether it was derived from the Greeks or the Phœnicians is doubtful. There are slight traces of writing in Britain previous to the Roman period, but if it were employed by the Druids, as Cæsar says, it may have existed without leaving remains. The Germans claim the knowledge of writing previous to their contact with the Romans; but in their case also we are without early remains. The Runic alphabet used for many centuries in Denmark, Norway, etc., may have been employed long before the Christian era.

In the East we find one of the most striking contrasts in the history of language. The Chinese, who have an ancient system of writing which they attribute to Fou-hi, have never reached the alphabetic system. Their characters are syllabic, and as Chinese words are monosyllables, they are strictly ideographic. They have been adopted in this way by peoples speaking not only different dialects, but different languages, who apply the signs to words of different sound but of the same signification as the original. The Chinese system is said to contain 40,000 characters. They were originally hieroglyphic, but from difficulty of interpretation have become conventional. There are, of course, certain general principles of combination and construction, but to master the whole system is said to be the work of a lifetime. Only a limited portion of it can, therefore, have any real existence as a medium of communication. Sanskrit, on the other hand, possesses the most perfect known alphabet. The Hindus claim to have derived it from the gods, and call one form of it *devanāgari* (divine city). It is wholly different from the Semitic, and is founded on a much more complete and subtle analysis of sound. Its consonant signs number 33, its vowel signs 14. They are applied with an analytical method which gives a power of distinction vastly superior to that of European alphabets, and which is greatly admired by scholars. Sanskrit is written from left to right. By means of its derivatives it is widely diffused in the East. The Pali, which forms the sacred language of the Buddhists, has carried it far beyond India. The Burmese Pali character is square, the Siamese round. To complete the vagaries which have prevailed in the direction of writing, the Mexican picture writing was written from bottom to top. See ALPHABET; CUNEIFORM WRITING; ETYMOLOGY; HIEROGLYPHICS; LANGUAGE, SCIENCE OF; PALÆOGRAPHY; SPEECH.

WRONG, George Mackinnon, Canadian educator: b. Ontario, 25 June 1860. He was educated at University and Wycliffe colleges in Toronto, took orders in the Church of England 1883, but has since devoted his entire time to academical work, and in 1894 succeeded Sir Daniel Wilson as professor of history in the University of Toronto. He has published 'The British Nation: a History' (1903); 'The Earl of Elgin' (1905); 'A Canadian Manor and Its Seigneurs' (1908); 'The Fall of Canada' (1914). He is co-editor with H. H. Langtoe of the annual *Review of Historical Publications Relating to Canada*, founded in 1897.

WRYBILL, an extraordinary plover (*Anarhynchus frontalis*) of New Zealand, which is unique in having a bill bent sideways near the tip,—always toward the right. By this peculiarly adapted instrument it seems to be able to reach and obtain many small crustaceans, etc., which are able to creep under stones out of reach of all the other shore-birds of the region, which have only the ordinary straight kind of

beak. The questions and inferences which arise in the mind of the evolutionist in view of this case will be found treated in Newton's 'Dictionary of Birds,' with references to other authorities. See PLOVER, and consult Buller, 'Birds of New Zealand' (London 1888).

WRYNECK, a European bird (*Iynx* or *Yunx torquilla*), related to the woodpeckers, which has a habit of twisting its head in a curious manner. This bird visits Great Britain in summer, arriving in April, usually with or just before the cuckoo, and hence is named the "cuckoo's mate." The food consists of insects, and chiefly of ants and their pupæ. It is also said to eat elderberries. The tongue is long and extensile, like that of the woodpeckers. The nest is formed in the holes of trees, and the eggs vary from six to 10.

WRYNECK. See TORTICOLLIS.

WU-CHANG, woo'chäng', or **WOO-CHANG**, China, a city of the province of Hupeh, on the Yang-tse-kiang, opposite the city of Hankow. The latter is in effect but a suburb of Wu-chang, another portion on the north bank of the river being Hanyang. It is the great emporium for the tea exported by way of Shanghai. It has a government college and mint, a college, cotton mills and an electric-lighting plant. Pop. variously estimated from 500,000 to 700,000.

WU-HU, woo'hoo', China, a treaty-port, opened in 1877, in the province of Ngan-hwei, on the right bank of the Yang-tse-kiang River, about 200 miles west of Shanghai and 60 miles above Nanking. Some manufactures and a considerable trade are carried on. Canals connect the city with a large productive region. Cutlery and red cord are its principal products. Its annual commerce now aggregates about $22,000,000. Wu-hu suffered severely in the Tai-ping rebellion. Pop. about 92,000.

WU TING-FANG, Chinese statesman and diplomat: b. Singapore, 1842. He was educated at Saint Paul's College, Hongkong, and studied law at Lincoln's Inn, London. He was in the service of the colonial government as interpreter in the law courts in 1862–74, and after his return from England in 1877 he engaged in law practice in Hongkong. In 1882 he was appointed to the official staff of Li Hung Chang, at that time governor-general of Chih-li and Grand Chancellor of China. He was one of the peace commissioners who, under the leadership of Li Hung Chang, negotiated the Treaty of Shimonoseki at the conclusion of the Chino-Japanese War, and he later occupied high governmental offices at Peking. He was appointed Minister to the United States in 1896, but in 1902 he was recalled to China to aid in the negotiation of several commercial treaties. He was appointed to the new board of commerce in 1903; was Minister of the Board of Punishments in 1905–06, and in 1906 he remodeled the Penal Code. He was again Minister to the United States in 1908–09, where his broad statesmanship, deep learning and great diplomatic talent gained for him widespread respect and liking. He was made member of the permanent Court of Arbitration at The Hague. He published 'America Through Oriental Spectacles' (1914).

WUCHOUSEN, the great wind eagle, a mythological character, universally believed in by the numerous tribes of Algonquin Indians. Of him many fabulous stories are told. According to the Passamaquoddy legend, in which he is called The-Bird-who-Blows-the-Winds, Wuchousen lives far in the north, on a huge rock whose top reaches up into the region of the cloudland, at the very end of the sky. When he flaps his wings the winds blow over all the earth and all the cloudland. In the olden days Wuchousen was so fond of blowing, of flapping the wind with his monster wings, that men could not live in peace, for the fear of the tempest was ever upon them. So terrible were these tempests that even Kulóskap, the Master of Men and Beasts, was often afraid to venture out upon the sea to fish as was his pleasure. At last he made up his mind to bring the wind eagle to time and make the earth safer for all. So he made a long journey into the far northland, on the very outer border of the world. There he found Wuchousen flapping his mighty wings and screeching louder than the howling tempest he was winging up. Kulóskap protested against this, representing to the wind eagle that he had already made the world uninhabitable and requested him to modify his tempest-making. To this Wuchousen replied that since time began he had blown always in this way, that his wings needed exercise and that he proposed to go on flapping them no matter what happened to the rest of creation. In a rage, Kulóskap, changing himself into a monstrous giant, higher than the clouds, seized the wind eagle and, tying his wings together, cast him down from his high cliff into the sea thousands of feet below. Unable to move, the eagle exercised all his magic power and made the waters so putrid that they poisoned all the streams and the rain that fell from the clouds, so that Kulóskap was forced to release him, for being a spirit, he could not kill him. But that he might not again incommode and endanger the world, he left one of his wings tied, when he replaced him on top of his high cliff. Since that time, in the long past, Wuchousen has been able to raise a wind only half so strong as he used to; and though he often raises a tempest, yet, flapping only one wing, he soon grows tired and then the tempest subsides.

WULFENITE, native lead molybdate. It is generally admitted that the best specimens of this mineral are among the most beautiful minerals known. It crystallizes in hemimorphic tetragonal crystals. They are usually in square tabular plates, sometimes very thin and transparent, but occasionally in elongated pyramidal forms and nearly opaque. The mineral also occurs in crystalline masses. It is very brittle, has a hardness of about 3 and is very heavy, its specific gravity ranging from 6.7 to 7.0. Its lustre is resinous to adamantine, and colors are various shades of yellow, orange, red, grayish or greenish. It is associated with other lead ores at many localities, as in Austria-Hungary, and New South Wales, but the United States localities are far more important. Magnificent specimens occur in the Red Cloud and Mammoth mines of Arizona, in the Organ Mountains,

New Mexico, at Eureka, Nev., and Tecoma, Utah. It was named in honor of the Austrian mineralogist, Wulfen, and has been used to a limited extent as an ore of molybdenum.

WULFSTAN, wŭlf'stăn, **WULSTAN,** or **WOLSTAN,** (1) Anglo-Saxon prelate: b. Long Itchington, Warwickshire, about 1007; d. Worcester, 18 Jan. 1095. Educated at Evesham and Peterborough, he became a monk in the monastery of Worcester and in 1062 was consecrated bishop of Worcester. He was one of those who submitted to William the Conqueror at Berkhampstead in 1066, and was allowed to retain his see. The crypt of the present Worcester cathedral represents the church which Wulfstan caused to be erected between 1084 and 1089. He was a man of saintly character and loyal devotion to his work, and he is credited with having induced the merchants of Bristol to stop their traffic in slaves. He assisted in the Domesday survey, and led the defense of Worcester against the rebellious nobles, commanded by Roger de Montgomery. He was buried in Worcester cathedral, and was canonized in 1203, his day being 19 January. Consult 'Life,' by William of Malmesbury, 'De Gestibus Pontificum.' (2) Wulfstan: b. about 950; d. 1023. He was archbishop of York, and has been regarded as the author of 'Wulfstan's Homilies,' first printed in 1701. (3) Wulfstan of Winchester, a monk of the 9th century, who wrote metrical lives of Saint Swithin and Saint Ethelwold.

WUNDT, Wilhelm (Max), German physiologist, psychologist and philosopher: b. 16 Aug. 1832, near Mannheim. During the years 1851–56 he studied at Tübingen, Heidelberg and Berlin. In 1857 he became privatdocent, and in 1864 assistant professor of physiology at Heidelberg where he remained until 1874. Here he wrote his first important books 'Die Lehre vom der Muskelbewegung' (1858), 'Beiträge zur Theorie der Sinneswahrnehmung' (1858–62), 'Vorlesungen ueber die Menschen- und Tierseele' (1863; 4th ed., 1906), 'Lectures on Human and Animal Psychology,' trans. by J. E. Creighton and E. B. Titchener, 1894), 'Lehrbuch der Physiologie des Menschen' (1865; 4th ed., 1878), 'Grundzüge der physiologischen Psychologie' (1874; 6th ed., 1908–11). In the 'Vorlesungen' and the 'Grundzüge' Wundt points the way to a new psychology, one defined not by a differentiation of objects, but by point of view, one that is experimental in its method, and one capable of including much of the psychology of Herbart and Lotze, the psychophysics of Weber and Fechner, and the sense-physiology of J. Müller and Helmholtz. In 1874 Wundt went to Zürich as professor of philosophy, and in the following year was called to a similar chair at Leipzig where he has since remained. In 1879 he established the first psychological laboratory and in 1883 the *Philosophische Studien,* devoted chiefly to the contributions of the Leipzig school. This ceased publication with the 20th volume in 1903, but a new series, the *Psychologische Studien* was begun in 1906. In 1896 appeared 'Grundriss der Psychologie' (Outlines of Psychology, trans. by C. H. Judd, 1897; 3d ed., 1907), and in 1900 the first installment of his 'Völkerpsychologie' (Vol. V of the 2d ed., completed in 1914), the development of language, custom and religion from the psychological point of view.

Meanwhile he found time also for philosophy. 'Logik,' an inquiry into the theory of knowledge and the methods of scientific investigation, was published in 1880–83, 'Ethik,' an investigation of the facts and laws of the moral life, in 1886 (Eng. trans. by E. B. Titchener, J. H. Gulliver and M. F. Washburn, 1897), 'System der Philosophie,' in 1889, 'Einleitung in die Philosophie,' in 1901, and 'Kleine Schriften,' Vol. 1, philosophical essays, in 1910. Wundt's system of philosophy has been characterized as the science of the sciences. He attempts to "unite into a consistent system the general knowledge contained in the various sciences, and to trace back to their principles the general methods and presuppositions of science in general." As regards his success, Külpe says, "Wundt's ability to familiarize himself thoroughly with all fields of knowledge, and to enrich them all by his ingenious combinations, by his inspiring ideas and researches, and by a rare gift for systematic-architectonic analysis, has made him not only the greatest all round scholar of our time, but also the most successful representative of those who aim at a mediation between philosophy and the special sciences. In this respect he may be called a modern Aristotle or Leibnitz."

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WUOTAN, the High German name of the Teutonic god of the winds and storms. See ODIN.

WUPPER, voop'pĕr, Germany, a river in the governments of Cologne and Düsseldorf of the Prussian province of the Rhine. It rises on the Westphalian frontier, and flows first northwest and then southwest, joining the Rhine between Cologne and Düsseldorf after a course of about 60 miles. It is not navigable for vessels of any size, but it provides considerable power for manufacturing purposes. Its valley is the most populous in Germany and contains the important industrial towns of Barmen, Elberfeld and Solingen. In its upper course it is called the Wipper. Consult Schmidt, A., 'Die Wupper' (Lennep 1902).

WURDHA, wûr'da, India. See WARDHA.

WURMSER, voorm'zĕr, **Dagobert Siegmund,** COUNT VON, Austrian general: b. Alsace, 22 Sept. 1724; d. Vienna, 22 Aug. 1797. He served three years in the French army, but

left it for the Austrian service, where he commanded a hussar regiment during the Seven Years' War, attaining the rank of major-general. During the Bavarian war of succession he commanded a special corps of the army in Bohemia, and after the peace was made commanding general in Galicia, and in 1787 general of cavalry. By the outbreak of the French Revolution his family lost their estates in Alsace. In May 1796 the critical condition of affairs in Italy after the defeat of Beaulieu led to the appointment of Wurmser to the command of the second Austrian army destined to act against Bonaparte. At the head of 60,000 men he obliged the French to raise the siege of Mantua; but the defeat of his main body at Castiglione, Roveredo and Bassano, rendered his situation extremely critical. He finally forced his way into Mantua, of which the blockade was resumed. A third Austrian army was sent into Italy, but the defeat of Arcole prevented it from relieving him; and at length, in February 1797, seeing the impossibility of any longer maintaining the defense, Wurmser surrendered Mantua to Napoleon and was himself allowed his freedom.

WURORA, India. See WARORA.

WURTS, John, American educator and legal writer: b. Carbondale, Pa., 10 July 1855. He was educated at Yale and after traveling in Polynesia as a newspaper correspondent (1876–77) was graduated from the Yale Law School in 1884 and practised his profession in Jacksonville, Fla., 1884–96. From 1897 he was professor of the law of real property and equity at Yale and was lecturer on law of contracts at West Point in 1916. In 1914–15 he was exchange professor at the University of California. He is joint author of 'Minor and Wurts on Real Property' (1910); 'Complete Revision to Date of Florida Index Digest' (1910); and author of 'The Anti-Slavery Movement with its Relation to the Federal Constitution' (1883); 'Washburn on Real Property' (1902); 'Cases in Federal Practice' (1905); 'A Bit of Judicial History' (1911); 'Jury System Under Changing Conditions' (1912).

WURTTEMBERG, vürt'tĕm-bĕry, or **WURTEMBERG,** until 1918 a southwestern state and kingdom of the late German empire, between Bavaria, Baden, Hohenzollern, and the Lake of Constance, which separates it from Switzerland; area, 7,534 square miles. It was formerly included in the territory of Swabia (q.v.). Except a few tracts in the south, the surface is hilly and even mountainous. In the west the Schwarzwald, or Black Forest, forms part of the boundary, and the Alb or Rauhe Alp, forming part of the Franconian Jura, covers an extensive tract. The country belongs in large part to the basin of the Rhine, being drained northward into that river by the Neckar, while the Danube flows across the southern districts. A part of the Lake of Constance is also included in Wurttemberg. The climate is temperate. In the lower and more favorable districts the fig and melon ripen in the open air, and the vine, cultivated on an extensive scale, produces several first-class wines; maize, wheat, hops, tobacco and fruit, which is employed in cider making, are chiefly cultivated. About a third of the country is under forests, which consist mainly of oaks, beeches and pines. Of minerals, the most valuable are iron and salt, both of which are worked by the government; the others are limestone, gypsum, alabaster, slate, mill-stones and potter's-clay. The manufactures consist chiefly of cotton, woolen and linen goods, paper, wooden clocks, toys, musical instruments and chemical products. The government until November 1918 was a hereditary constitutional monarchy, the executive power being lodged in the sovereign, and the legislative jointly in the sovereign and a parliament, composed of an upper and a lower chamber. The yearly revenue from all sources is about $32,000,000, and the public debt, the bulk of which was incurred in constructing the state railways, was, previous to the war of 1914–18, about $160,000,000. There was no exclusively established religion under the monarchy, but the king was invested by the constitution with the supreme direction and guardianship of the Evangelical Protestant Church. Education is generally diffused and the centre of the educational system is the University of Tubingen. Besides Stuttgart (the capital), the chief towns are Ulm, Heilbronn and Esslingen. The history of the state is of little general interest. Previous to the Napoleonic era the rulers had the title of duke, but in 1806, by the favor of Napoleon, the then duke gained a great accession of territory, as well as the title of king. In the subsequent arrangement of the European states by the Congress of Vienna the territorial accessions were confirmed and the kingly title formally recognized. In the war of 1866 Württemberg sided with Austria against Prussia. It became a member of the German empire on its foundation in 1871. After the collapse of the German imperial armies on the western front in November 1918 and the establishment of a republic in Berlin, the Württemberg monarch abdicated the throne and Württemberg became a constituent state of the Republic. Pop. 2,437,574. Consult Gaupp, 'Das Staatsrecht des Königsreichs Württemberg' (Freiberg 1895); Hirschfeld, 'Württembergs Grossindustrie und Handel' (Leipzig 1889); Belschner, 'Geschichte von Württemberg' (Stuttgart 1902); Schliz A., 'Urgeschichte Württembergs' (Stuttgart 1909).

WURTZ, vürts, **Charles Adolphe,** French chemist: b. Strassburg, 26 Nov. 1817; d. Paris, 12 May 1884. He went to Paris in 1845, in 1851 became professor at the Agronomic Institute, Versailles, in 1853 was made professor of organic chemistry at the Sorbonne and professor of toxicology at the Ecole de Médecin. From 1866 to 1876 he was dean of the Sorbonne faculty of medicine. He made important discoveries in connection with compound ammonias, glycol and adol; and rendered a valuable contribution to theoretical chemistry in distinguishing the atomic relations of organic compounds. Among his numerous works on chemistry are 'La théorie atomique' (1878); 'Leçons élémentaires de chimie moderne' (1868); 'Traité de chimie biologique' (1885). Consult Friedel, 'Notice sur la vie et les travaux de C. A. Wurtz' (1884).

WURTZ, Henry, American chemist: b. Easton, Pa., 5 June 1828; d. 10 Nov. 1910. He was graduated from Princeton in 1848, studied

further at the Lawrence Scientific School of Harvard, was State chemist of New Jersey 1854–56, chemical examiner in the United States Patent Office 1859–61, and from 1871 to 1875 edited the *American Gas Light Journal*. He was closely identified with the earlier investigations of natural and artificial gas and the use of petroleum as fuel. He proved the existence of gold in sea water. In 1888 he entered the employ of T. A. Edison (q.v.), as chemist, and afterwards made several important chemical discoveries, chief of which is that of the geometrical laws of the condensation of chemical modules. Other important investigations are described in his scientific monographs. Author of 'Obtaining Potash Compounds from Greensand Marl' (1850); 'Geometrical Chemistry' (1876); 'Discovery of Lake Superior Silver Minerals, Huntilite and Animikite' (1878), etc.

WURTZILITE, an asphalt (elaterite) mined extensively in Wasatch County, Utah, and used for roofing material, waterproof felts, building paper, rubber substitutes and paving materials. Color black, but deep red in thin plates. Practically insoluble in gasoline (76°) and only partly soluble in ether, carbon disulphide, turpentine and carbon tetrachloride.

WURTZITE (named for C. A. Wurtz, q.v.), *in mineralogy*, a dimorphous form of zinc blende. Crystallization, hexagonal; hardness 3.5 to 4; specific gravity, 3.98; lustre, resinous; color, brownish black; streak, brown; composition, a sulphide of zinc, ZnS; occurrence, in a silver mine near Oruro, Bolivia, in Portugal, Peru, and near Butte City, Mont. Its artificial manufacture is accomplished by fusing equal parts of zinc sulphate with calcium fluoride and barium sulphide.

WÜRZBURG, Bavaria, city and capital of Lower Franconia, on the river Main, 62 miles southeast of Frankfort and at the junction of the main railway lines to Nuremberg and Bamberg. The river is crossed here by three bridges, of which the first is a stone structure built in 1474–1607; while the modern bridges were built in 1887 and in 1894. The town is built on both sides of the river, but the main portion of it is on the north bank. The older portion of the city is of quaint and irregular pattern, but the modern suburbs are handsomely laid out, with broad promenades. There are many mediæval buildings in a good state of preservation and several ancient churches. Among the churches are the Romanesque cathedral dating from 1042–1189, with additions of later date; the Marienkapelle, a Gothic structure built in 1377–1441; the Haugerstiffs Church, in Italian Renaissance style, 1670–91; the Neumunster Church, dating from the 11th century, and the church of Saint Burkhard, built in 1033–44. A notable structure is the palace, built in 1720–44 as a residence for the bishops and grand dukes of Würzburg. The bishopric dates from 741, but the town existed earlier. From the 12th century the bishops had ducal authority. The bishopric was secularized by the Peace of Lunéville in 1803, and Würzburg came under Bavarian control. By the Peace of Pressburg in 1805 it became an electorate under Ferdinand III, former grand duke of Tuscany, who took the title of Grand Duke of Würzburg and joined the confederation of the Rhine. It was restored to Bavaria in 1815. A new bishopric, without ducal authority, was established in 1817. The city was bombarded and captured by the Prussians in 1866.

The University of Würzburg (q.v.) adds considerably to the importance of the town, and there are also schools of agriculture and horticulture, a royal music school and other educational institutions. The city is surrounded by vineyards which produce excellent wine. Manufactures include furniture, machinery, scientific instruments, railway carriages, brick, chocolate, beer, malt and vinegar. It is an important commercial centre. Pop. about 84,496.

WÜRZBURG, University of, a German educational institution founded at Würzburg, Bavaria, by Bishop Julius in 1582. An earlier university of the same name existed at Würzburg for a short time after 1403, but passed out of existence. The university was founded as a Roman Catholic institution and its chairs of theology and philosophy were held by Jesuits until the suppression of the order in 1774, but theological instruction remains in Roman Catholic hands. The faculty of medicine early became famous and has remained the most important in the university; taking, with its kindred departments of dentistry and pharmacy, more than half the students enrolled. The university was reorganized after Würzburg passed under Bavarian control in 1803. The library contains nearly 400,000 volumes. There are about 1,400 students and 100 instructors. Here W. K. Röntgen conducted the experiments which led to his discovery of the Röntgen rays in 1896.

WUSHKUM (from the name of their chief village), meaning a species of louse or flea, a tribe of the Chinookan stock of North American Indians. They call themselves *Thaq-luit*, and are the Echeloot of Lewis and Clark and the Wisham, Wishram, etc., of other writers. They occupy the north bank of Columbia River, Washington, from Tenino to the neighborhood of White Salmon River. They subsist largely on salmon, and are not reservation Indians, although they took part in the Yakima treaty of 1855. As they are given to wandering up and down the coast and as they have mixed, to some considerable extent, with neighboring tribes, it is very difficult to estimate their population.

WUTHERING HEIGHTS, Emily Brontë's one novel, was published in 1847 under the pseudonym "Ellis Bell." Though an almost complete failure with both the public and the critics it was reissued in 1849 with an introduction by Emily's more famous sister, Charlotte, the author of 'Jane Eyre.' The work is a belated and unconventional specimen of the so-called Gothic Romance or novel of terror, inaugurated by Horace Walpole's 'Castle of Otranto.' Its scene is a bleak mansion on the Yorkshire moors, the home of the Earnshaw family, into which is introduced the foundling Heathcliff, picked up by Mr. Earnshaw on the high road. The story deals with the fiercely revengeful life of Heathcliff, who develops under ill usage and neglect an appalling cruelty, coupled with an inflexible will and a strange power of fascination. He gains control of the Earnshaw property and brings up Hareton, an

of the besotted Hindly Earnshaw, whom he hates, in brutal ignorance. The one redeeming trait in his distorted and Satanic nature is his wild love for Hindley's sister, Catherine, which outlives both her marriage to Edgar Linton and her death. Thwarted by Catherine's daughter in his endeavor utterly to debase Hareton Earnshaw, Heathcliff starves himself to-death, haunted and exhilarated by the spectral presence of the woman who, despite his cruelty, of which she herself felt the effect during her life, has always belonged to him in spirit.

The story is a wild and passionate one, far remote from real life, which Emily Brontë knew scarcely at all. Scenes of domestic violence succeed each other in a way which is almost too much for the reader's nerves. The characters are the creation of a lawless but extraordinarily vivid imagination, and the whole novel is written with an energy which triumphs over the obvious limitations of its author's art. The best edition, with introduction, etc., is that by Clement K. Shorter, 'The Complete Works of Emily Brontë' (Vol. II). Consult also, Shorter, C. K., 'Charlotte Brontë and her Circle'; and the essay on Emily Brontë in 'Swinburne's Miscellanies.' JAMES H. HANFORD.

WYANDOT, or HURON (English adaptation of the French *Ouendat*, or *Hoüandate*, later written *Guyandotte*, from the native name *Gendat*, signifying, "They are islanders"). A tribe composed of the remnants of several politically independent Iroquoian tribes and confederacies whose political integrity was destroyed by the Iroquois during the middle of the 17th century. Among these peoples may be mentioned the ancient Wendat (or Houandate), or Huron confederacy, which was composed of four tribes, namely, the Attigneenongnahac, the Attignawantan, the Arendahronons and the Tohontaenrat (or Tohontakenrat), and also, later, the affiliated tribes known as the Ataconchronons (Atarochronons), the Wenrôhronons, and the Atontbratarhonons (Muskrat people), the last being Algonquian; and the Tionontateronons, the Attiouendaronk (Attiouendarankhronon) or Neuter Nation, and lastly, the Eries. To the Attiouendaronk may be added the small affiliated tribes known as the Aondironon and the Ongniarahronon (Ongmarahronon). The first known habitat of these several peoples was south and east of Lakes Huron and Erie, in the present States of Ohio and Pennsylvania and western New York, in Ontario, Canada, and the northern shore of the Saint Lawrence River as far down as the site of Quebec. To-day the Wyandots so-called live in Oklahoma, where they number about 300; and at Lorette, Quebec, Canada, where some Hurons who are in fact Wyandots, dwell, numbering about 400; the whole aggregating about 700. All these tribes when first encountered by Europeans were organized into well-governed communities. The social and political organizations were based strictly on bloodkinship, real or fictitious. Fictitious kinship was obtained through the rites of adoption. These peoples dwelt in lodges constructed of bark, which were long in figure, sometimes having as many as 10 or 12 fires with a family on two sides of each fire. The lodges were usually collocated into villages, many of which were quite strongly palisaded. For their sustenance they depended chiefly on agriculture, raising corn and beans of several varieties, squashes and sunflowers for oil. They tanned and dressed the hides of the animals which they killed. The prepared skins they neatly and skilfully utilized in the preparation of their raiment and their bedding. Reeds and barks of various kinds were useful in making mattresses and other needed articles. The title to their lands was vested solely in the mothers of the people. The choice of a candidate for chief for either of the two grades of this office was solely a prerogative of the mothers of the clan to which the chiefship belonged. The chief held his office during his good behavior.

WYANDOTTE, Mich., city situated in Wayne County, about 10 miles southwest of Detroit, on the Detroit River and on the Grand Trunk, the Lake Shore and Michigan Southern, the Michigan Central and the Detroit, Toledo and Ironton railroads. Wyandotte is a thriving industrial centre, having chemical and salt works, ironworks, shipyards, fur-coat and robe factories, sash and door works, and stove factories. Internal combustion engines, automobiles and their accessories are also manufactured here. The Filbert Memorial Hospital is at Wyandotte and there are a public library, churches, schools, etc. The commission form of government is in operation. The city's receipts from all sources in 1918 amounted to $53,398.81, of which $22,923.17 was an unexpended balance from the year previous. The total disbursements for the same period were $41,682.01. The real property valuation is $12,547,610, and the personal $3,222,070. Pop. 12,000.

WYANDOTTE CAVE, in Crawford County, Ind., a natural formation, five miles northeast of Leavenworth, second in size to Mammoth Cave (q.v.), but having a greater number and variety of stalactites and stalagmites than any other cave in the United States. It has been explored for a distance of 23 miles. The chambers and galleries are numerous, some about 350 feet long and 180 feet high. Some of the remarkable features are Monument Mountain, about 175 feet high, and 75 feet above its crests is the grand dome. The Pillared Place contains several clusters of stalactites, and the Pillar of the Constitution, a large stalagmite 30 feet high and 75 feet in circumference. There are 144 places of unusual interest named. Consult Hovey, H. C., 'Celebrated American Caverns' (1896); and Indiana State Geological Reports.

WYANT, wī'ant, **Alexander Helwig,** American artist: b. Port Washington, Ohio, 11 Jan. 1836; d. New York, 29 Nov. 1892. After trying the saddlery business, he turned to art, became a painter of landscapes at Cincinnati, exhibited in the National Academy of Design in 1865, was elected associate of the academy in 1868, and academician in 1869. In 1865 he went to Europe, becoming a pupil of Hans Gude at Carlsruhe. He attained high rank in landscape art, painting almost exclusively American scenes, and being particularly successful in views from the Adirondack wilderness. His chief characteristics are subtle tones, the evanescent moods of nature that he was quick and able to catch, and a delicate

quality of workmanship. His work is well represented in the Metropolitan Museum, New York. He was a founder of the American Water-Color Society. Among his works are 'Scene on the Upper Susquehanna' (1869); 'Pool on the Ausable' (1871); 'In the Adirondacks' (Metropolitan Museum); 'A North Woods' Brook'; 'An Old Clearing'; 'Pool in the North Woods'; 'New Jersey Meadows' (1872); 'Sunset on the Prairie' (1876); 'Reminiscence of the Connecticut' (1878); 'Evening' (1885); 'Sunset near Killarney' (1886); 'October Day' (1892).

WYATT, wī'at, **James**, English architect: b. Burton Constable, Staffordshire, 3 Aug. 1746; d. Marlborough, Wiltshire, 5 Sept. 1813. He was taken to Rome in 1760 by Sir William Bagot, and during the next six years studied architecture in that city and in Venice. Returning to London, he brought himself into notice by his designs for the Pantheon, in Oxford street, a building for many years famous as the rendezvous of the fashionable world. He received innumerable commissions for private residences in all parts of the kingdom; but his designs, for the most part in a sort of Græco-Italian style, have little at the present day to recommend them. About 1782 he turned his attention to Gothic architecture, being one of the first to attempt its revival; and for many years was employed as a restorer of cathedrals and parish churches, in the course of these labors making sad havoc, at Salisbury, Hereford, Durham and elsewhere. It must be said, however, that his imperfect conceptions of Gothic art were shared by his contemporaries and approved by the taste of his time, in large measure. His most famous work in this style was Fonthill abbey, erected for Beckford in 1795. He held the position of surveyor-general subsequent to 1796, and in 1802–03 was president of the Royal Academy. George III employed him at Windsor. Wyatt is often referred to as "The Destroyer."

WYATT, Sir **Matthew Digby**, English architect and art writer: b. Rowde, near Devizes, Wiltshire, 1820; d. London, 21 May 1877. He made a diligent study of the architecture of Italy, France and Germany, returning to England in 1846 to publish his 'Geometrical Mosaics of the Middle Ages' (1848). In 1856 he was appointed architect to the East India Company, and made many important designs for public works in Great Britain and India; in 1866 was awarded the royal gold medal of the Royal Institute of British Architects; and in 1869 was knighted and made Slade professor of fine arts at Cambridge. His chief books are 'Metal Work and its Artistic Design' (1852); 'Industrial Arts of the 19th Century' (1853); 'Art Treasures of the United Kingdom' (1857); 'Fine Art' (1870); 'Architect's Handbook in Spain' (1872).

WYATT, Sir **Thomas**, English poet: b. Kent, about 1503, d. Sherborne, Dorsetshire, 11 Oct. 1542. He was graduated from Cambridge in 1518, may have studied at Oxford, and subsequently went on his travels to the Continent. After his return to England he appeared at court, where the reputation he had already acquired as a wit and a poet introduced him to the notice of Henry VIII, who retained him about his person and knighted him in 1537. He was employed on several diplomatic missions to different powers, and was a friend of Thomas Cromwell (q.v.), in whose fall he ran some risk of being involved. In 1542 he was returned to Parliament as knight of the shire for Kent. A close student of foreign literature, Wyatt introduced the sonnet into England from Italy. In this he is commonly associated with Henry Howard, Earl of Surrey, but is more correctly to be regarded as the pioneer. None of Wyatt's verse, sacred or secular, appeared in his lifetime. Some of the secular poems were printed (96 are assigned to Wyatt) in the 'Songes and Sonnettes' (1557) of Richard Tottel, commonly known as 'Tottel's Miscellany.' There are among the extant works 31 sonnets, and satires in heroic couplets, imitated from Persius and Horace. Wyatt's poems evince more elegance of thought than imagination, while his mode of expression is far more artificial and labored than that of Surrey. Consult Nott's edition of Wyatt and Surrey with the elaborate memoir prefixed thereto (1816); also the article by Churton Collins in T. H. Ward's 'English Poets' (1883), and Simond's 'Sir Thomas Wyatt and his Poems' (1889). Consult also Foxwell, A. K., 'Study of Sir Thomas Wyatt's Poems' (New York 1912) and Padelford, F. M., 'Early XVIth Century Lyrics' (London 1907).

WYCHERLEY, wich'er-lĭ, **William**, English wit and dramatist: b. Clive, Shropshire, about 1640; d. London, 1 Jan. 1716. About 1655 he went to France for his education, but he returned to England a short time before the Restoration, and was entered a gentleman commoner of Queen's College, Oxford, which he left without a degree, and took chambers in the Middle Temple. He paid, however, little attention to the law, but became a man of fashion in the town, and made himself known as author of 'Love in a Wood, or Saint James's Park' a comedy, published about the end of 1671. This piece brought him into much notice, and his popularity was increased by comedies that soon afterward followed: 'The Gentleman Dancing-master,' published in 1673; 'The Country Wife,' produced in 1672 or 1673, and 'The Plain Dealer,' 1674. He became a favorite of the meretricious Duchess of Cleveland, and was much regarded by Villiers, the witty and profligate Duke of Buckingham. About 1680 he improved his circumstances by marrying the Countess of Drogheda, a young, rich and beautiful widow. At her death soon afterward she settled her fortune upon him; but, his title being disputed, the costs of law and other encumbrances produced embarrassment, which ended in arrest. He remained in confinement seven years, until released by James II, who, it is said, was so pleased with his comedy of 'The Plain Dealer' that he ordered his debts to be paid, and added a pension of £200 per annum, which he lost at the revolution. The succession to his father's estate, which was strictly entailed, does not appear to have relieved him from the embarrassments into which he had again fallen, and from which he found a deliverance only a few days before his death in marrying a young woman with a fortune of £1,500. Besides the plays already mentioned he wrote poems of no value or

advocate of the sanitation of ports not only in the United States, but in the West Indies and South America, holding that if this were enforced yellow fever would be entirely eradicated from the Western hemisphere. On his recommendation the government set apart a large tract of land at Fort Stanton, New Mexico, for a hospital whither all consumptive patients in the United States marine hospitals could be transferred.

WYMORE, Neb., city in Gage County, on the Big Blue River, 45 miles south of Lincoln, and on the Chicago, Burlington and Quincy Railroad. There are railroad machine shops and the city is a shipping centre for grain and livestock. Pop. about 2,613.

WYNANTS, wī'nänts, or **WIJNANTS, Jan**, Dutch painter: b. Haarlem, between 1615 and 1620; d. about 1680. Very little is known of his life except that he was master of Adrian Vandevelde, Wouwerman and other eminent painters, and that he was naturally indolent and given to pleasure. His works are consequently few, but are highly valued for their technical merits. They consist of landscapes of small size, the figures and cattle in which were often executed by other hands. He is represented in the galleries of Amsterdam, The Hague, Munich and in the National Gallery, London.

WYNDHAM, Sir Charles, English actor: b. Liverpool, 23 March 1837; d. London, 12 Jan. 1919. He was the son of a physician, studied medicine and surgery in Germany and passed all his examinations brilliantly. During the Civil War he enlisted with the Union forces in the United States and served continuously until the close of the war, being present at the battles of Chancellorsville, Fredericksburg and Gettysburg and through the Red River campaign with General Banks. On quitting the army he made his initial American stage appearance in 'Brothers and Sister' and two years later returned to England, where he supported Henry Irving and Ellen Terry in many plays. When he reappeared at the Wallack Theatre, New York, in 1869 he made an excellent impression as a light comedian, and organized a touring company of his own, which went to all of the larger cities of the United States. His repertory was extensive. 'The School for Scandal,' in which he appeared as Charles Surface, was one of his greatest successes, and 'Pink Dominoes' which he produced in 1877, ran for 500 nights. For 20 years Sir Charles successfully managed the Criterion, New and Wyndham's theatres in London. He was knighted by King Edward in 1902. Consult Scott 'The Drama of Yesterday and To-day' (1899).

WYNDHAM, George, English cabinet officer: b. London, 29 Aug. 1863; d. 1913. He was educated at Eton and Sandhurst Royal Military College. He served through the Suakim campaign and at Cyprus in 1885, and was private secretary to A. J. Balfour (q.v.) 1887-92. He also sat in Parliament for Dover from 1889, was Parliamentary Under-Secretary of State for War 1898-1900, became chief secretary for Ireland in 1900 and entered the Cabinet in 1902. In March 1903 he introduced the Irish land purchase bill subsequently passed. His resignation as chief secretary was brought about by the Orange Unionists. He published an edition of 'North's Plutarch' in the 'Tudor Classics' (1894); 'Shakespeare's Poems' (1898); 'Ronsarde and La Pléiade' (1906).

WYNDHAM, Sir William, English statesman: b. Orchard-Wyndham, Somerset, 1687; d. Wells, Somerset, 17 June 1740. He was educated at Oxford and entering the House of Commons for his native county, identified himself with the tories, became secretary of war in 1711, and in August 1713 was transferred to the office of Chancellor of the Exchequer. He was suspected of treasonable relations with the Pretender, and lost his office on the death of Queen Anne. On the outbreak of the rebellion in Scotland under the Earl of Mar in 1715, an order for Wyndham's confinement was issued, and he was arrested at his house in Somerset, but escaped. A reward of $5,000 was offered for his apprehension. After lurking for some time in disguise he surrendered himself and was committed to the Tower. Released without a trial, he remained until his death a leader of the Parliamentary opposition to the ministry of Sir Robert Walpole. He was a very graceful, clear, forcible and spirited orator. One of his sons, Percy, took the name of O'Brien and in 1756 was made Earl of Thomond.

WYNNE, win, Charles Whitworth. See CAYZER, SIR CHARLES WILLIAM.

WYNNE, Ark., county-seat of Cross County, on the Missouri Pacific Lines, Little Rock, Ark., to Memphis, Tenn., and Saint Louis to New Orleans, 45 miles west of Memphis. It is the trading centre of a rich farming country with good department stores, wholesale grocery houses, railway division headquarters, a flour mill, cotton gins, a stave factory, hoop factory, electric lighting and water systems, automobile garage and repair plants. Its educational facilities are excellent and it has a good courthouse and high school building. The town is administered by a mayor and council. Pop. 5,000.

WYNTOUN, win'tŏn, Andrew of, Scottish rhyming chronicler: b. about 1350; d. after 1420. He was a canon regular of the priory of Saint Andrews, and was in 1395 prior of Saint Serf's Inch, in Lochleven, probably holding this office until his death. Wyntoun's 'Oryginale Cronykil of Scotland' is the first historical record in the Scottish vernacular. It received little attention until 1795, when David McPherson published an annotated edition of a part of it. David Laing edited a complete edition of this work (3 vols., Edinburgh 1872-79) and an edition from the Wemyss Manuscript was prepared for the Scottish Text Society (1906). Wyntoun's 'Chronicle' bears the usual character of the historical writings of the age in the indiscriminate mixture of tradition with history, but he appears to have been faithful to his authorities, whom he sometimes literally transcribes. Wyntoun's scholarship appears to have been considerable and the candor and generosity with which he speaks of the enemies of his country are commendable.

WYOMING (Indian, *Maughwauwama*, "big plains"), a State of the United States, in the Rocky Mountain region, between the parallels, lat. 41° and 45° N., and between long.

104° 3' and 111° 3' W. Portions of the Louisiana Purchase, the Oregon claim, the Texas annexation and the Mexican cession are included in the State. It is bounded on the north by Montana, east by South Dakota, south by Colorado and Utah, and west by Utah, Idaho and Montana. The boundary lines are all straight. The greatest extent is from east to west, 355 miles (north to south, 276 miles). Area (excluding Yellowstone National Park), 97,575 square miles. Wyoming ranks eighth in size among the States of the Union.

Topography.— The State averages from 5,000 to 7,000 feet above sea-level and is traversed by the main chain of the Rocky Mountains. From the plateau lands rise a number of lofty ranges and peaks, some of them approaching 14,000 feet in altitude. The largest mountain masses are in the southern, northwestern and north central parts of the State. In the extreme northeast, the Black Hills of South Dakota project into Crook and Weston counties. Other conspicuous groups of outlying hills in this region are the pine-clad Hartville Mountains, north of Guernsey, and the Bear Lodge Mountains. The principal mountains in the south are, first, the Laramie Mountains, which rise to an average height of 1,000 feet above the plain, culminating in Laramie Peak (9,020 feet) and the Medicine Bow Mountains, called locally the Snowy Range, a lofty mass on whose western slopes gather the waters of the North Platte. The highest point in this range is Medicine Bow Peak (12,005 feet). The western watershed of the North Platte is formed by the Sierra Madre Mountains, projecting north from Colorado. In the extreme southwestern corner of the State are the lofty Uintah Mountains. The general trend of all these is northwest and southeast, save the Uintah Mountains, which run east and west. The entire northwest portion of the State comprises a lofty mountain mass broken here and there by small valleys. The Absaroka Range (partly in the Yellowstone National Park) forms the Continental Divide. To the west lie the Teton and Snake River ranges near the Idaho boundary. The highest point is the Grand Teton (13,747 feet). To the south and east of these lie the Gros Ventre, Salt River, Wyoming and Wind River ranges, the latter projecting well into the west central portion of the State and including such lofty peaks as Fremont (13,730 feet), Gannett (13,785 feet), the highest in the State, and Atlantic (12,700 feet). In north central Wyoming are the isolated Big Horn Mountains, culminating in Cloud Peak (13,165 feet). Other minor ranges cross south central Wyoming, prominent among them being the Green, Ferris, Seminole, Shirley and Rattlesnake mountains. These are small separated groups lying a little east of the Continental Divide, but indicating the general course of the Rockies. In this region also are the huge bare granite heaps and domes rising from the sandy plains north of the Sweetwater, known collectively as the Granite Mountains. The Continental Divide extends from the middle of the southern boundary in a northwesterly direction through Yellowstone National Park.

Lofty plateaus characterize all portions of the State and include the Cheyenne Plains and Goshen Hole in the southeast and east, the Laramie Plains (7,000 feet) and Red Desert in the south, lower Wind River Valley in the west central and Big Horn Basin in the northern part of the State. These are either level or rolling and lie mainly between 4,500 and 7,000 feet elevation. The eastern plains are grassy, the western and higher plateaus are covered with the characteristic sage brush. Within the mountain ranges are many small sheltered valleys or parks, the most noteworthy being Jackson's Hole in the northwest. There are several gaps in the Continental Divide of varying accessibility. Bridger's Pass (used by the Union Pacific Railroad) in southern, and South Pass in central Wyoming are the most available for railroad construction. North of these lie Union Pass and Two Ocean Pass, which are suitable only for wagons and pack trains. Hot springs are found in the region included in and adjacent to the Yellowstone National Park, at Thermopolis and elsewhere. The Thermopolis Springs (135° F.) are of medicinal value and annually attract thousands seeking the cure.

Hydrography.— The general drainage in the eastern two-thirds of the State is from south to north; in the west from north to south. The State is included within four distinct drainage areas. The major portion lies within the Missouri Basin, comprising the valleys of the North Platte, Sweetwater, Wind, Big Horn, Powder, Belle Fourche and Cheyenne rivers. The western part of the State is cut by Green River, an affluent of the Colorado, and hence within the Gulf of California drainage system. North and west of Green River rises Snake River, a tributary of the Columbia and hence within the Pacific drainage area, while through the extreme southwestern part of the State flows Bear River, the principal affluent of the Great Salt Lake, and, accordingly, a water of the Interior Basin. The water surface of the State totals only 320 square miles. The largest lakes are Yellowstone, Jackson and Shoshone, all in the northwest. There are many small lakes amid the mountains, small bodies of clear water surrounded by wooded mountains.

Geology.— Wyoming lies partly in the Great Plains and partly in the Rocky Mountain provinces, thus presenting the three chief divisions of land forms, namely, plains, plateaus and mountains. The salient structural features of the region are great anticlinal folds separated by deep synclinal basins, some of which are 100 miles long and 20 to 50 miles wide. Formations of pre-Cambrian age are exposed along the crests of the major mountain ranges, namely, the Laramie, Medicine Bow, Wind River, Big Horn and Black Hills. The rocks which compose these formations constitute a complex group of metamorphosed sediments and associated igneous intrusives. The Paleozoic is but slightly developed. Formations of Cambrian, Ordovician, Mississippian, Pennsylvanian and Permian age are found over the northern and western portions of the State. The Mesozoic is represented by slight developments of the Triassic, Jurassic and Lower Cretaceous, while the Upper Cretaceous attains a thickness of several thousand feet. The Cenozoic is characterized by a great thickness of continental Tertiary formations rich in mammalian fossils. Volcanic eruptives of Tertiary age cover large areas in and adjacent to the Yellowstone National Park. Wyoming's chief contributions to

geology are found in the rich reptilian fauna from the Cretaceous and the mammalian fauna from the Tertiary and in the unsurpassed geysers of the Yellowstone. The chief resources thus far developed are oil from the Pennsylvanian and Cretaceous, and coal from the Cretaceous and Tertiary.

Minerals and Mining.— The mineral resources of the State are annually attracting greater notice. Fourteen out of the 22 counties are producers of metallic minerals. The relatively small quantities of gold, silver and copper, the metals for which the State has been prospected, have led to an underestimation of the State's resources. Placer gold was found at Atlantic City in west central Wyoming in 1842 and subsequently in small quantities in the Grand Canyon of the Snake. Lode deposits have been worked in the north Laramie Mountains and elsewhere intermittently since 1871. The veins are not phenomenally rich but are believed to persist in depth. The future of gold mining here depends on increased capital investment, modern methods of ore treatment and improved transportation and power facilities. In 1915 Wyoming ranked 15th among the States in gold production. To 1911 the total placer yield was estimated at $1,725,000; the lode yield at $4,137,000. The following table shows the production in recent years:

YEAR	Fine ounces
1913	847
1914	324
1915	672
1916	4,054

Silver is usually found in conjunction with gold especially in the western part of the State. The following table shows the value of the silver mined in the State during the past few years:

YEAR	Value
1912	$200 00
1913	2,254 00
1914	100 00
1915	1,400 00
1916	3,092 00

A considerable portion of Wyoming is underlaid with bituminous coal of excellent quality. The best fields are those near Newcastle and at Hanna, Rock Springs, Kemmerer and Dietz. Other rich deposits exist in the north and northwest but have not been developed to any extent. In 1914 the State produced 6,475,293 tons; in 1915, 6,554,028 tons; and in 1916, 7,500,000 tons. In 1915 Wyoming ranked sixth among the States in the production of iron ore, yielding in that year 998,845 gross tons. Copper is found in central Wyoming and in the Medicine Bow Mountains in the south. The production in recent years has been as follows: 1914, 165,023 pounds; 1915, 1,020,926 pounds; 1916, 2,569,000 pounds. Petroleum is already one of the most important mineral products and the State gives every promise of becoming a leader both in production and in quality of output, some geologists even having gone so far as to say that Wyoming is literally underlaid with a sea of oil. The existence of petroleum has been known for years, but among the first to call attention to its commercial possibilities was the late Prof. Wilbur C. Knight of the State University. The cretaceous shales that have been drilled contain oils with both a paraffine and an asphalt base. Many of the former are of unsurpassed quality. The principal fields thus far developed are the Salt Creek, Powder River, Big Muddy, Basin, Lost Soldier, Pilot Butte, Crow Creek, Torchlight, Lovell, Little Buffalo and Rock Creek. The largest producing fields are the Salt Creek and Big Muddy. Early in 1918 the bringing in of a well on Rock Creek, 50 miles north of Laramie, gave great promise of large quantities of rich oil with a paraffine base in a hitherto little exploited field. In nearly all the fields the oil lies at a depth of 1,500 to 4,000 feet. The difficulties now encountered include lack of transportation facilities and detailed geologic studies of the State and the danger of litigation. The following table shows the production since 1912:

YEAR	Barrels
1912	1,572,[illegible]
1913	2,[illegible]
1914	3,[illegible]
1915	4,[illegible]
1916	6,672,[illegible]
1917	8,[illegible]
1918	10,[illegible]

Natural gas has been encountered in many oil fields and is used locally. In the Salt Creek field the conservation of the natural gas has become a model for the country.

Climate.— The extremes of temperature exist for a short period each year. The records show the maximum to be 116° above zero and the minimum, 45° below zero. The highest is usually about 100° and the lowest —30°. The mean temperature for January in Cheyenne and vicinities is 25.1°; in the northern part of the State, 18.1°. The mean temperature for the whole State for July is 67°. The extreme cold is not severe because of the dryness of the atmosphere. The precipitation varies from 8 to 18 inches, the average being 12.5 inches. A heavier rainfall in the Bear Lodge and Black Hill district is not unusual. The lofty and well-timbered mountain ranges receive a great deal of moisture both in the form of winter snows and, during the summer, as frequent heavy dashing rains. High winds prevail in many parts of the State, especially in spring. The climate is uniformly salubrious and various points are becoming prominent as health resorts.

Soil.— The soil of nearly all the river valleys is a dark loam and most fertile. On the higher lands and mountain slopes occurs a sandy loam, most of which is productive under irrigation. In the eastern counties dry farming has been practised on the whole successfully. The Red Desert is the only large infertile area in the State. Extreme aridity is here combined with alkali deposits. The soil in all the high mountain intervales or parks is very rich and, although at too high an altitude for cereal crops, produces large yields of nutritive native hay.

Flora and Fauna.— In Wyoming are found widely-varying types of animal and plant life. This is due largely to the diversified climatic conditions occasioned by extremes in altitude and a wide range of local physiographic conditions. The lower portions of the State (nearly one-third the total area) are marked by the broad-leaved cottonwood, juniper, salt-bush and yucca. A little higher, in the so-called Transition Life zone, covering about half the

WYOMING.

Estimated population, 179,559

COUNTIES

Pop. 1915			Pop. 1915		
8,194	Albany	G 12	5,398	Natrona	D 10
6,815	Bighorn	B 8	3,488	Niobrara	D 15
2,316	Campbell	B 12	5,473	Park	B 5
8,412	Carbon	G 10	5,277	Platte	F 14
3,626	Converse	D 13	15,429	Sheridan	A 9
5,117	Crook	A 13	10,642	Sweetwater	G 6
9,833	Fremont	D 6	6,051	Uinta	E 2
5,035	Goshen	F 15	1,744	Washakie	C 8
8,191	Hot Springs	C 6	4,414	Weston	C 13
3,238	Johnson	B 10	....	Yellowstone National Park (No population shown)	A 2
14,631	Laramie	G 14			
13,581	Lincoln	D 2			

Incorporated Cities, Villages, Etc.

673	Afton	E 2	55	Lost Cabin	D 8
157	Baggs	H 8	80	Lost Spring	E 14
728	Basin	B 7	640	Lovell	A 7
141	Big Piney	E 3	434	Lusk	E 15
1,246	Buffalo	B 10	182	Lyman	H 3
232	Byron	A 7	133	Manville	E 14
1,023	Cambria	C 15	67	Marbelton	E 3
2,639	Casper	E 11	170	Medicine Bow	G 11
11,320	Cheyenne	H 14	226	Meeteetse	B 5
1,035	Cody	B 5	131	Moorcroft	B 14
305	Cokeville	F 2	651	Newcastle	C 15
630	Cowley	A 7	65	Opal	G 3
177	Dayton	A 9	650	Pinebluff	H 15
1,018	Diamondville	G 3	83	Pinedale	E 4
111	Dixon	H 8	406	Powell	A 6
1,845	Douglas	E 12	2,975	Rawlins	G 9
142	Dubois	C 4	57	Riverside	H 10
177	Elk Mountain	G 10	803	Riverton	E 7
218	Encampment	H 10	195	Rock River	G 12
2,756	Evanston	H 2	5,699	Rock Springs	G 5
220	Glenrock	E 12	425	Saratoga	H 10
134	Granger	G 4	12,713	Sheridan	A 9
505	Gillette	B 13	278	Shoshoni	D 7
1,219	Green River	H 5	265	South Superior, Sweetwater	G 6
421	Grey Bull	B 8	524	Sublett	G 3
239	Guernsey	F 14	341	Sundance	B 15
227	Gunn	G 5	1,382	Superior	G 6
105	Hartville, Laramie	G 14	1,191	Thermopolis	C 7
428	Hudson, Fremont,	D 6	443	Torrington	F 15
204	Jackson	D 2	219	Upton	B 15
1,481	Kemmerer	G 3	54	Van Tassell	E 15
1,726	Lander	E 6	76	Wamsutter	G 8
8,256	Laramie	H 12	810	Wheatland	G 14
			454	Worland	C 8

State, one finds the yellow pine, narrow-leaved cottonwood and pure sage brush; higher still the spruce, fir, lodgepole pine and aspen covering the mountain slopes and higher foothills. The very highest portions of the State produce only the white barked pine, the dwarfed spruce and fir, while the mountain peaks are well above timber-line and are characterized by Arctic flora.

About 13 per cent, or 12,500 square miles of the State is timbered. Of this 3,500 square miles are located within the Yellowstone National Park, and 13,490 square miles within United States forest reserves.

The fauna of the lower altitudes includes the coyote, badger, ground-squirrel, prairie-dog, gopher, cottontail rabbit, among the mammals, and such birds as the mourning dove, warbler and lark. Reptiles are few. The animal life of the Transition zone includes the white-tailed deer, coyote, jack-rabbit, cottontail rabbit, skunk, sage-hen, hawk and various types of lizards. Still higher one finds the elk, snow-shoe rabbit, mountain lion, black bear and an occasional grizzly. All life is rare above 12,500 feet and mammalian life practically non-existent at this elevation.

Game.— Wyoming is still one of the most favored resorts of sportsmen. The vicinity of Jackson's Hole in the northwestern corner of the State abounds in elk and deer. In many other portions hunting is also excellent. Besides elk and deer, bear, mountain lions, mountain sheep, wolves, grouse, etc., are found in nearly every county. The game laws are liberal. The streams are richly stocked with trout and Wyoming until 1919 was one of the few States not requiring fishing licenses so abundant is the supply.

Agriculture and Stock Raising.—Agriculture has made rapid strides during the past few years. In many ways it is still in the experimental stage and its possibilities limited by a cool climate due to low average base level. There are, however, certain areas of comparatively low elevation and moderate climate where a variety of crops and some of the hardier fruits have proved decidedly successful. A special value attaches to these low-lying districts inasmuch as they are immediately surrounded or bordered by extensive non-agricultural areas where mining, lumbering and stock raising are the principal industries. The melting snows of the mountains furnish a never-failing supply of water for irrigation purposes and Federal, State and private irrigation projects have already reclaimed considerable sections. In 1910 out of the total number of farms (10,987) 6,297 were wholly or in part under irrigation, the total irrigated acreage being 1,333,302, an increase of 87.1 per cent over 1900. The largest proportion of irrigated farms is in Park County (96.5 per cent), but in four other counties the proportion is over 80 per cent. Of the various irrigation enterprises in the State, 71.8 per cent are operated by individuals or partnerships; 7.8 per cent by commercial concerns; 10.3 per cent by co-operative enterprises, leaving only 10.1 per cent controlled by the various governmental projects. In 1910 there were 13,231 miles of irrigation ditches. In that year about one-eighth of the total area of the State was in farms or ranches. The average value of farm land was $10.41 per acre though in Big Horn County the average rose to nearly $50. An indication of the tendency for agriculture to supplant stock raising is seen in the fact that in the decade 1900 to 1910, there was an increase of 80.3 per cent in the total number of holdings but a decrease of 41.7 per cent in the average number of acres per holding. In the same period the value of farm lands increased 279.4 per cent, being placed in 1910 at $88,908,276, while the average value of farm land per acre increased 261.5 per cent. Tenant farming is growing though not alarmingly. Much valuable agricultural land in the valleys and basins awaits development. The following table shows the acreage, yield and value of the principal crops in 1916:

CROP	Acreage	Production	Value
Hay (tame)	580,000	1,044,000 tons	$12,528,000
Wheat	170,000	3,670,000 bu.	5,322,000
Oats	250,000	8,750,000 "	5,250,000
Potatoes	18,000	2,340,000 "	2,995,000
Barley	25,000	825,000 "	718,000
Corn	25,000	550,000 "	495,000
Rye	16,000	248,000 "	268,000

The raising of orchard and small fruits and of sugar beets though at present slight is annually increasing. There are three sugar factories in the State, at Lovell, Sheridan and Worland.

Both northern and southern Wyoming is still in large measure devoted to stock raising, though beef cattle are shipped from every county in the State. In 1917 there were on the ranches 825,000 head as compared with 750,000 in 1916. Sheep grazing has become a very important industry. Only the best breeds of sheep are kept, and the wool is of superior quality and its yield above the average. The following table indicates the extent of sheep grazing:

YEAR	Sheep of shearing age and number of fleeces
1910	4,650,000
1911	4,000,000
1912	3,900,000
1913	3,600,000
1914	3,560,000
1915	3,630,000
1916	3,675,000
1917	4,381,000

The Agricultural College and Experiment Station located at Laramie, the seat of the State University, have done much, through experimentation and extension instruction, to encourage types of agriculture and stock raising suited to the conditions of the State. At the present time (1919) county agricultural agents are maintained in 17 out of the 22 counties.

Manufacturing.— In 1909 the State had 268 manufacturing establishments (169 in 1904) giving employment to 3,393 persons of whom 2,867 were wage-earners. The principal concerns are railroad shops, lumber camps and factories, flour and grist mills, printing and publishing establishments, dairies, sugar factories and oil refineries. The total value of manufactured goods was estimated at $6,249,000. Eight per cent of the factories were in Cheyenne. Electric power is only slightly used. In 1909, 93.3 per cent of the primary power was derived from steam.

Transportation and Roads.— The oldest railroad in the State is the Union Pacific, crossing the southern tier of counties. From Granger in Sweetwater County the Oregon Short Line runs northwest through Lincoln County into Idaho. A number of subsidiary lines connect with the Union Pacific, chief among them being the Colorado, Wyoming and Eastern and the Saratoga and Encampment. From Cheyenne the Union Pacific has a line to Denver. The Chicago, Burlington and Quincy enters the southeast corner of the State to Cheyenne. Its main line, however, runs diagonally across the State from Nebraska to Montana through Goshen, Platte, Converse, Natrona, Fremont, Hot Springs, Washakie and Big Horn counties. A branch line runs to Cody in Park County. The Burlington also runs across the northeast corner of the State from South Dakota to Montana through Weston, Crook, Campbell and Sheridan counties. A branch runs to Buffalo in Johnson County. The Chicago and Northwestern, crossing the eastern boundary of the State in Niobrara County, parallels the main line of the Burlington through Converse and Natrona counties and terminates at Lander in Fremont County. The Colorado and Southern, running north from Denver through Cheyenne, connects with the Burlington at Wendover and the Northwestern at Orin Junction. There is a lack of north and south lines. Most of the railroads run in general east and west, tending thereby to divide the economic interests of the State into horizontal belts or zones.

Wyoming is rapidly developing a system of excellent highways. The Lincoln Highway parallels the Union Pacific and the Oregon Trail the Oregon Short Line. In general these roads are kept in good condition. An improved highway runs north from Cheyenne through Laramie, Platte, Converse, Natrona, Johnson and Sheridan counties into Montana, serving as one of the approaches to the Yellowstone National Park. Other roads leading into the northeastern counties, and from Rawlins and Green River and Lander into Jackson's Hole and the Yellowstone National Park are available for automobile traffic. In 1917 the legislature created a State Highway Commission to co-operate with the Federal government under the act of Congress of 11 July 1916, entitled "An Act to provide that the United States shall aid the States in the construction of rural post roads, etc." State funds for the construction of highways are provided for by a tax of one-fourth mill on the dollar of valuation.

Wealth and Taxation.— In 1913 Wyoming's total receipts of income amounted to $1,529,474. Of this $849,277 was appropriated for strictly governmental costs and the balance for other purposes. The principal sources of revenue are the general property, business and license taxes and amounts derived from interest, leases and rents, and from grants and earnings of general departments. The total value of State property in 1913 was estimated at $897,500.

Charitable and Penal Institutions and Public Health.— There is a State Board of Charities and Reform, comprising five ex officio members. This board has general oversight over all State supported charitable, reformatory and penal institutions, including the State Hospital at Rock Springs, the branch hospitals at Sheridan and Casper, the Soldiers' and Sailors' Home at Buffalo, the School for Defectives at Lander, the Wyoming Industrial Institute at Worland, the Insane Asylum at Evanston, the State Penitentiary at Rawlins. At Laramie is located the Cathedral Home for Children, maintained by the Protestant Episcopal Church.

The State Board of Health, appointed by the governor with the confirmation of the senate, comprising three persons, one of whom must be a physician, appoints the county health officers, inspects public institutions in the interest of health and sanitation, makes quarantine regulations and advises counties and municipalities regarding drainage, water supply and general problems of sanitation. The State dairy and food commissioner is charged with the enforcement of all laws touching frauds, adulterations and impurities in foods. The practice of medicine, dentistry, pharmacy, nursing, embalming and optometry is regulated by laws the administration of which is in the hands of a series of State appointed boards.

Education.— Provision for public education was made at the first session of the Territorial assembly in 1869. Owing to the low density of population the problem of elementary education has been largely the problem of rural education. Educational facilities, however, have more than kept pace with the growth in population. The increase in the number of schoolhouses was slow to 1905, but since 1909 the number has doubled, reaching, in 1914, a total of 879. The number of teachers has likewise shown a marked increase. In 1894 there were 407; in 1904, 763; in 1914, 1,488. Less than 12 per cent of the teachers are men. The cost of education in 1914 was 37.93 cents per pupil per day. In 1914 there were 29,155 pupils enrolled. Since 1901 free textbooks have been provided. Certification regulations were first adopted in 1876. Various changes were made in the law till, in 1917, the whole matter was carefully gone over and an entirely new system of certification was adopted. In 1916 there were 26 four-year high schools in the State with a total enrolment of 1,648 pupils. At first public education was surpassed in importance by private education. The situation is now quite the reverse. In 1872 was established the short-lived Wyoming Institute, a Baptist school, at Laramie. Two years before, Saint Mary's School, a Roman Catholic institution, had been established at Laramie, but made little headway till after a decade. In 1885 this was supplanted by the much larger and better equipped school in Cheyenne established by the Society of the Holy Child Jesus. The first kindergarten in Wyoming was privately established in Cheyenne in 1886. In 1894–95 the Wyoming Collegiate Institute was founded at Big Horn but lasted only a short time. In 1905 was opened the Cheyenne Business College, and, in 1909, under the auspices of the Christian Church there was established Jireh College at Jireh, Niobrara County. The State University at Laramie, the creation of which was urged as early as 1878 by the governor of the Territory was not established till 1887. In 1870 the Protestant Episcopal Church opened an Indian

school among the Shoshones. In recent years the task of educating the Indians has been undertaken more seriously both by the churches and the government. The *Wyoming School Journal*, a periodical devoted to educational matters, issued under the auspices of the State Teachers' Association, was published for a time in the '90's. In 1904 it was re-established. There has been steady improvement in the standards of education and in school administration. In 1917 was created the State Board of Education, comprising seven members appointed by the governor for six years. The board prescribes educational policies for the State, exercises general supervision over public education, prepares outlines of study, establishes standards of work and rules for the certification of teachers. The general administration of the rules and regulations of the board is in the hands of the commissioner of education, appointed by them. Each county elects a superintendent of schools on a non-partisan basis and each school district elects its own trustees. Teachers' institutes are provided by law. At the 1917 session of the legislature the State accepted the terms of the act of Congress providing for Federal aid in vocational education.

Government.— The Territory of Wyoming was created in 1868; the State in 1890. Equal suffrage was adopted by the first session of the Territorial assembly, making Wyoming the first Territory or State to permit full woman's suffrage. This provision was incorporated in the State constitution drawn up in 1889 and afterward ratified. In general, women voters in Wyoming have not aligned themselves with any one party or on any single issue but divide as the male voters divide. The principal executive officers are the governor, secretary of state, treasurer, auditor, commissioner of taxation, superintendent of public instruction, attorney-general and examiner. The governor receives $4,000. The salaries of the remaining range from $2,400 to $3,600. Besides the above there is a State fish commissioner, game warden, food commissioner, highway engineer, commissioner of labor, geologist and adjutant-general. There are three justices in the Supreme Court, each receiving $5,000. There are seven judicial districts, the judges in each receiving a salary of $4,500. The State legislature, which meets biennially for not more than 40 days, comprises 27 senators and 57 representatives. The salary of each is $5 a day and mileage. The capitol is at Cheyenne. Wyoming has but one representative in Congress. There are 22 counties with the usual county officials. In 1910 there were 48 incorporated cities and towns. Most cities have the mayor-council type of government. In 1911 an act of the legislature made the commission form permissive. Only one city adopted this type of municipal government and afterward abandoned it. A bill to provide for the city-manager type was introduced in the 1917 session of the legislature but was defeated. A list of the Territorial and State governors appears elsewhere on this page.

Population.— The census of 1910 gave a total population of 145,965. In 1916 the population was estimated at 179,559. Of the population in 1910, 29.6 per cent was urban. There was a sex ratio of 168.8 males to 100 females. Among the native whites the ratio was 147.1 to 100, and among the foreign-born whites, 287.2 to 100. Of the total native-born population only 27.2 per cent were born in Wyoming, the remaining 72.8 per cent being natives of other States in the Union. Of the foreign-born, 14.6 per cent were Austrians, 11 per cent English, 9.7 per cent Germans, 9.2 per cent Swedes, 7.2 per cent Italians, 6.7 per cent Scotch. The counties of Albany, Laramie and Sheridan had, in 1910, a density of two to six to the square mile. All the other counties had less than two to the square mile.

GOVERNORS OF WYOMING.

TERRITORIAL

John A. Campbell		1869–75
John M. Thayer		1875–78
John W. Hoyt		1878–82
William Hale		1882–85
Francis E. Warren		1885–86
George W. Baxter*		1886
Thomas Moonlight		1887–89
Francis E. Warren		1889–90

STATE

Francis E. Warren	Republican	1890
Amos W. Barber*	"	1890–92
John E. Osborne	Democrat-Populist.	1893–95
William A. Richards	Republican	1895–99
De Forest Richards	"	1899–1903
Penimore Chatterton*	"	1903–05
Bryant B. Brooks	"	1905–11
Joseph M. Carey	Democrat	1911–15
John B. Kendrick	"	1915–17
Frank L. Houx*	"	1917–19

* Acting Governor.

History.— Wyoming was the meeting point of a number of Indian tribes. In the southeast were the Arapaho and Cheyennes of Algonquin stock; in the north and east, the Crows and Sioux; and in the west and southwest, the Utes of Shoshonean stock. There are ancient traditions of Spanish exploration into southern Wyoming at a very early date but no adequate proof has been offered of their presence prior to the 19th century, although somewhat earlier the Indians seem to have been familiar with the Spaniards and to have had commercial intercourse with Santa Fé. The first white man to enter Wyoming of whom there is definite record was de la Verendrye, who, in 1743, advancing from Lake Nepigon, penetrated the eastern portion of the State to within sight of the Big Horn Mountains. This was an isolated venture, however, and was not followed up by further exploration on the part of the French. The expedition of Lewis and Clark did not touch Wyoming although a number of the men who accompanied it subsequently joined the various fur-trading expeditions that were quick to take advantage of the information about the west brought out by these earliest American explorers. A number of these companies operated in Wyoming, including that of Manuel Lisa, who set out from Saint Louis in 1807 and established a post at the mouth of the Big Horn River in Montana. That fall or early next spring, John Colter set out southward up the Big Horn and entered Wyoming. He advanced perhaps as far south as the site of Lander where he turned northwest and, in the course of his wanderings, probably penetrated the wonderland of Yellowstone National Park. Others of Lisa's men or the employees of the Missouri Fur Company (established 1808–09) may also have penetrated Wyoming from the north about this time. In the summer of 1811 the overland company

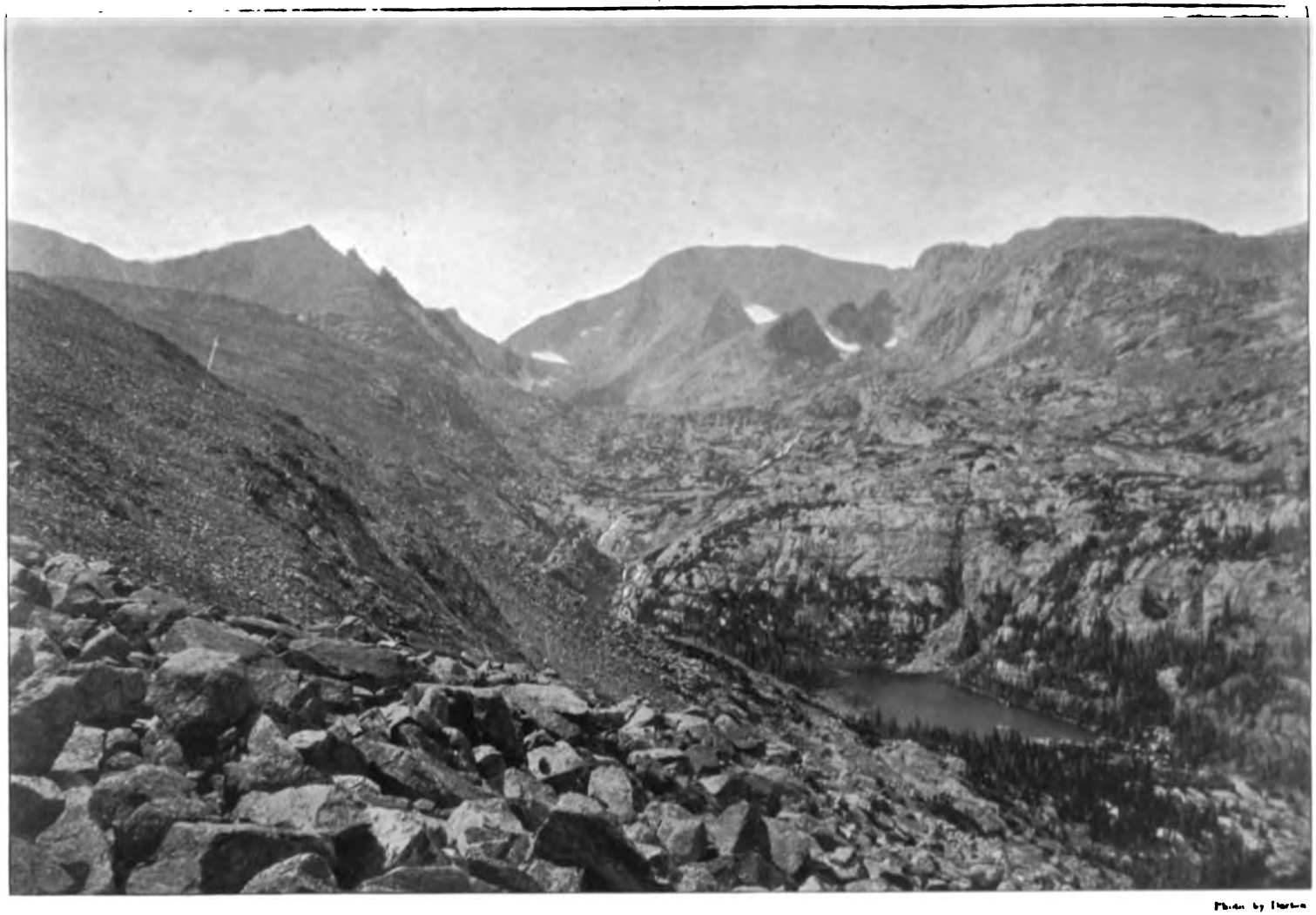

Photo by Burton

In the centre of Bighorn Mountains — Cloud Peak highest summit in distance. Granite rocks sculptured by glacial action

through the continued relinquishment of the northern part of the territory by the whites. In 1870 a number of citizens of Cheyenne organized a mining and prospecting company to explore the Big Horn country. The Sioux were apprehensive, however, and the expedition was abandoned. Four years later, this deferred reconnaissance took place but this time as an official expedition under General Custer, again causing great uneasiness among the Sioux. Actual war broke out in 1876 in which Custer lost his life. The Sioux, however, were crushed and Wyoming made safe for the whites.

In 1854 Wyoming had been a part of Utah Territory, Oregon Territory and the newly-created Nebraska Territory. In 1859 Washington Territory was set off, including part of western Wyoming. In 1861 a part of the southern portion was included within the newly-formed Idaho Territory. In 1865 a bill was introduced into Congress to create the Territory of Wyoming and in 1867 voters of Laramie County, including the city of Cheyenne, sent a delegate to Congress. He was not permitted to take a seat but his presence in Washington did much to hasten the actual creation of the Territory by act of Congress, under date 25 July 1868. At that time there were four counties, Laramie, Albany, Carbon and Carter (Sweetwater), each running the entire length of the State from north to south. Agitation for Statehood was begun in the 80's and in September 1889 a constitutional convention met in Cheyenne. Their work was afterward ratified. By act of Congress 10 July 1890 Wyoming was admitted as the 44th State of the Union.

During the 70's the cattle industry began and continued to be one of the most important in the State. Perhaps the most prosperous years were from 1880 to 1882. Since that time the open range has been gradually but very surely restricted, while several seasons of unwonted severity, notably that of 1886–87, retarded the industry. With the restriction of the range came a growing feeling of hostility between the large cattle interests and the small settlers, whose homestead locations covered the watering places to which the range cattle formerly had free access. Many of the settlers owned no cattle but eked out a precarious existence by stealing unbranded cattle (mavericks) from the herds of the great stock owners. In portions of the Territory it became impossible to get a jury of settlers to convict anyone of cattle-stealing (rustling). The cattlemen resorted to force and between 1889 and 1892 several supposed "rustlers" were lynched. This aroused an intense hatred against the cattlemen, several of whom were forced to leave Johnson County, the seat of most trouble, under cover of darkness and on swift horses. In 1892, however, the stockmen resolved on a coup and brought up from Texas an armed body of 50 men with the intention of invading northern Wyoming and killing the "rustlers." This culminated in the so-called Johnson County raid. Proceeding by rail to Casper the raiders started north toward Buffalo, learning on the way that several "rustlers" were at the K C ranch on Powder River. Most of the K C outfit were absent on the round-up and only "Nate" Champion and "Nick" Ray and two trappers, who had stayed over night, were in the cabin. The place was surrounded, the two trappers captured and Ray shot down as he started out of the cabin. Champion bore Ray into the cabin under a fusillade and then for hours defended himself and his wounded companion, taking time to keep a careful record of the details of his siege, hour by hour. Ray died in the course of the afternoon. Toward nightfall the besiegers fired the cabin and Champion, in undertaking to effect his escape, was shot down and killed. The raiders then started north toward Buffalo, but the alarm had been given and they turned in and fortified themselves at the T. A. ranch on Crazy Woman's Fork, 12 miles south of Buffalo. Here the besiegers became the besieged, holding out for over two days against an infuriated mob of over 400. The leader of the settlers, "Arapaho Brown," finally contrived what he called a go-devil, consisting of a breastwork of logs on wheels, which he proposed to move up toward the log buildings where the raiders were besieged and then to destroy the cabins with giant powder. Just before this prototype of the modern tank was started, in the early morning of the third day, Col. J. J. Van Horn of Fort McKinney, under orders from President Harrison, came to the rescue with three troops of cavalry. The raiders surrendered and were transferred to Cheyenne where they were released on bail on their own recognizance to appear for trial in January. At that time, on Johnson County's inability to pay the costs, the case was dropped.

Trouble has, from time to time, developed between the cattlemen and the sheepmen, in which some blood has been shed, but with the creation of the national forests and the regulation of grazing privileges, an amicable agreement has been arrived at.

In the last two decades the activities of the State have been devoted to developing the abundant natural resources available.

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WYOMING, Pa., borough in Luzerne County, on the Susquehanna River, five miles north of Wilkes-Barre, and on the Delaware, Lackawanna and Western and the Lehigh Valley railroads. It is situated in an iron and coal-mining district and there are manufac-

tures of paint, shovels and flour. Pop. about 3,010.

WYOMING, University of, located at Laramie, Wyo. It was chartered by the legislature of the Territory of Wyoming in 1886, and opened to students in 1887; the first State legislature in 1890 passed an act enlarging the scope of the University and also made the State Agricultural College provided by the national grants a part of the University organization. The State has since doubled its regular appropriation and made several others for special purposes. The University is open to women on equal terms; tuition is free except in the Department of Music. The educational policy of the University was liberal from the first; the preparatory and collegiate departments were the first established; the organization now includes the Preparatory School; the College of Liberal Arts; the Graduate School; the Normal School; the College of Agriculture and the Agricultural Experiment Station; the College of Engineering; the School of Mines; the School of Commerce; the School of Music; the department of secondary education, and a summer school. The College of Liberal Arts offers a classical, a literary and a scientific course and confers the degree of B.S. for the scientific course without Latin, and the degree of B.A. for all other courses. In each course the work of the Freshman year is required, the work of the Sophomore year partially elective, and the work of the Junior and Senior years almost entirely elective. The Graduate School was discontinued in 1914. The regular courses in the Normal School, the College of Agriculture, the College of Mechanical Engineering and the School of Mines are five years in length, including one preparatory year the degree of B. Ped. is conferred for the completion of the normal course; the degree of B.S. for the agricultural, engineering and mining courses. There are also a one year's course in the Normal School, a course in domestic science, a one year's and a two years' agricultural course and a ranchmen's winter course in the College of Agriculture, and a winter course of six weeks in the School of Mines. The School of Commerce offers two two-year courses in bookkeeping and in stenography; the School of Music a seven-years' course in piano. Instruction in military science and tactics is also given. The University has organized a University Extension Association, which conducts extension lectures in all parts of the State; a Correspondence Teaching Department is also conducted, by which some of the work toward a degree may be done. The campus now occupies over 40 acres in the eastern part of the city; the buildings are the Hall of Languages, the Mechanical Building, the Hall of Science, and the Gymnasium; the three first mentioned are built of gray sandstone, which is found near Laramie. The library contains about 35,000 volumes; the students number 603; and 80 professors and instructors.

The University of Wyoming, though in numbers one of the smallest of the State universities, is well equipped and maintains a high standard of scholarship, as the real head of the educational system of the State.

WYOMING VALLEY, a crescent-shaped valley in Luzerne County, Pa., traversed by the northern branch of the Susquehanna River; length, 21 miles. It is a fertile alluvial plain, with rich deposits of anthracite coal, and is noted for its beautiful scenery. The valley was claimed by the colony of Connecticut as early as 1753 and was first settled by people from Connecticut; the ensuing dispute between Pennsylvania and Connecticut over this territory is known as the "Pennamite and Yankee war," and was not finally settled till after the Revolutionary War. (See PENNSYLVANIA; *Boundary Controversies*). In 1782 a commission appointed by Congress decided in favor of Pennsylvania; an attempt was made to drive out the Connecticut settlers which led to a renewal of the war; but in 1788 Pennsylvania confirmed the titles of all actual settlers to their land, and all controversy was ended by 1800. During the Revolutionary War a large proportion of the men of the Wyoming Valley joined the Continental army; but a number of Tories were living in the valley; and in 1778, when they were joined by British troops and Indian allies, an attack was made upon the settlers who had taken refuge in Forty Fort, near Wilkes-Barre. The settlers did not number over 400, chiefly boys and old men; the British force, including the 700 Indians, was about 1,100. After a desperate battle fought on the 3d of July 1778 the settlers were completely defeated, about two-thirds being killed. They were forced to capitulate, and after the surrender many of the prisoners were tortured and killed by the Indians. The greater part of the inhabitants of the valley were compelled to flee to other settlements and endured great hardships. Consult Miner, 'History of Wyoming' (1845); Stone, 'Poetry and History of Wyoming' (1844); Peck, 'Wyoming: its History and Incidents' (1858); Smith, 'Story of Wyoming Valley' (Kingston, Pa., 1906).

WYOMINGITE, a rock consisting almost entirely of leucite and phlogopite, abundant in the Leucite Hills in Sweetwater County, Wyoming. Contains so much potash that it may become a source of that material.

WYON, wī'ŏn, **William,** English engraver and designer of coins and medals: b. Birmingham, 1795; d. Brighton, Sussex, 29 Oct. 1851. Having won several prizes for medals offered by the Society of Arts, he went in 1816 to London and was appointed second engraver at the mint, a post which he filled until the close of his life. In 1832 he was elected an associate of the Royal Academy, and in 1838 an academician, being the first of his department who had ever obtained these honors. His works, comprising coins, pattern pieces of coins not used, medals and seals are numerous. His coins cover a period of nearly 30 years, including the latter part of the reign of George IV, the reign of William IV, and the first 13 years of the reign of Victoria. Far more numerous than these are his war, scientific, artistic and testimonial medals, executed from his own or from Flaxman's designs, and in the highest style of art.

WYSS, vīs, **Johann Rudolf,** Swiss author b. Bern, 13 March 1781; d. there, 31 March 1830. He was educated at various German universities, became professor of philosophy at Bern in 1806, and later also chief librarian. His

'Der Schweizerische Robinson' (1812–13), an imitation of Defoe, was translated into various languages, the first series appearing in English ('The Swiss Family Robinson') in 1820, the second in 1849. Wyss also wrote 'Vorlesungen über das Höchste Gut' (1811), and 'Idyllen und Erzählungen aus der Schweiz' (1815–22); 'Reise im Berner Oberland' (1808); and edited the collection 'Alpenrose' (1811–30). Wyss is the author of the Swiss national anthem, 'Rufst du, mein Vaterland?'

WYTHE, with, George, American patriot: b. 1726 in the county of Elizabeth City, Va., a short distance from Yorktown; d. Richmond, Va., 1806. One of his ancestors was George Keith (1639–1716), a Scotch Quaker, distinguished as a mathematician and Oriental scholar, who emigrated to America about 1684. On account of his radical religious views and his opposition to slavery, he was often imprisoned. On 15 Oct. 1693 Keith issued an "Exhortation and Caution against buying or keeping Negroes," seemingly the earliest Quaker protest against slavery. These views were inherited by George Wythe. From his mother Wythe received a life-long bent toward classical scholarship. Even at the age of 80 he began to learn a new language. He was trained in the law by an uncle. Wythe's connection with the House of Burgesses, in Virginia, began on 27 Feb. 1752, on the eve of the French and Indian War. Hence he knew in a practical way the steps leading up to the Revolution, whose course he was destined to influence. He was a member of the Continental Congress and one of the signers of the Declaration of Independence. He sat in the Philadelphia Convention of 1787 and exerted himself to secure the ratification of the Constitution by Virginia the following year. For 10 years he was a member of Virginia's Supreme Court of Appeals, and for above 20 years sole chancellor of the State. However important and varied were such positions that he filled, George Wythe is not to be judged chiefly as statesman or jurist. He was greatest as teacher, and his most lasting work was the subtle influence of his singularly pure and lofty character. Either in his law office or as professor in William and Mary College, he was the teacher of Thomas Jefferson, John Marshall, James Monroe, Henry Clay and scores of other men only less prominent than these. With Jefferson, in particular, Wythe maintained a friendship and interchange of thought which had a bearing upon national concerns. So highly did Jefferson prize the work of Wythe as a teacher, that he exerted himself to establish, in 1779, in the College of William and Mary a chair of law, expressly for the occupancy of his "master and friend," as he delighted to call Wythe. Wythe was the first professor of law in the United States. William and Mary College was the second in the English-speaking world to have a chair of Municipal Law, George Wythe coming to such a professorship a few years after Sir William Blackstone. Jefferson, in writing from Paris in 1785 to Dr. Richard Price, an English opponent of slavery, gives striking evidence of his estimate of the services which Wythe was rendering to his country: "The College of William and Mary in Williamsburg, since the remodelling of its plan, is the place where are collected together all the young men (of Virginia) under preparation for public life. They are under the direction (most of them) of a Mr. Wythe, one of the most virtuous of characters, and whose sentiments on the subject of slavery are unequivocal." Henry Clay, in a letter of 3 May 1851, to B. B. Minor, says in reference to Wythe: "To no man was I more indebted, by his instructions, his advice, and his example, for the little intellectual improvement which I made, up to the period when, in my twenty-first year, I finally left the city of Richmond." "The most remarkable instance," says Munford, "of his genuine patriotism, to which I confess I am rendered most partial perhaps by my own experience of its effects, was his zeal for the education of youth. Harassed as he was with business; enveloped with perplexing papers, and intricate facts in chancery, he yet found time for many years to keep a private school for the instruction of a few young men at a time, always with very little, and often demanding no compensation." That Wythe conceived the training of publicists to be his true task appears from this sentence in a letter on 5 Dec. 1785, to John Adams: "A letter will meet me in Williamsburg, where I have again settled, assisting, as professor of law and police in the University there, to form such characters as may be fit to succeed those which have been ornamental and useful in the national councils of America." In three signal instances Wythe was a forerunner. As early as 1764 he wrote Virginia's first remonstrance to the House of Commons against the Stamp Act, taking so advanced a position in regard to that ominous act as to alarm his fellow-burgesses. He was perhaps the first judge to lay down, in 1782, the cardinal principle that a court can annul a statute deemed repugnant to the Constitution, thus anticipating by a score of years the classic decision of his great pupil, John Marshall, in the case of Marbury *v.* Madison. He was an ardent advocate for the emancipation of the slaves, not only infusing his students with his abolition sentiment, but actually freeing his own slaves and making provision for them in his will. His death occurred in Richmond, Va., in 1806, from poison administered by his great-nephew, who hoped to come thus into the inheritance of his estate. "No man," says Jefferson, "ever left behind him a character more venerated than George Wythe. His virtue was of the purest kind; his integrity inflexible, and his justice exact; of warm patriotism, and devoted as he was to liberty and the natural and equal rights of men, he might truly be called the Cato of his country, without the avarice of the Roman; for a more disinterested person never lived. Temperance and regularity in all his habits gave him general good health, and his unaffected modesty and suavity of manners endeared him to every one. He was of easy elocution, his language chaste, methodical in the arrangement of his matter, learned and logical in the use of it, and of great urbanity in debate. Not quick of apprehension, but with a little time profound in penetration, and sound in conclusion. His stature was of middle size, well formed and proportioned, and the features of his face manly, comely, and engaging. Such was George Wythe, the honor of his own and

the model of future times.' Wythe was the author of 'Decisions in Virginia by the High Court of Chancery' (1795; 2d ed., with 'Memoir' 1852).

SAMUEL C. MITCHELL,
President of Delaware College.

WYTHEVILLE, with'vĭl, Va., town, county-seat of Wythe County, on the Norfolk and Western Railroad, 130 miles west of Lynchburg and 215 miles southwest of Richmond. It is in a stock-raising and mining region and has considerable lumbering interests. It has iron works, woolen and knit goods factories, flour and lumber mills. The town has a county courthouse, Trinity Hall Female College (Lutheran), Wytheville Seminary (Protestant Episcopal), Academy of the Visitation (Roman Catholic), public elementary schools and two libraries. Pop. about 3,054.

WYTHEVILLE, Military Operations at. During the Civil War the lead mines and works near Wytheville assumed much importance. On 13 July 1863 Col. John T. Toland, with the Second West Virginia cavalry and 34th Ohio mounted infantry, about 800 men, started from Fayetteville, W. Va., to damage the lead works and destroy the railroad near Wytheville. On the evening of the 18th Toland arrived within five miles of the town and detaching two companies to destroy a railroad depot and track, 10 miles west, marched his remaining force into the town, which was defended by less than 200 men, under Major Bowyer, most of them distributed in houses and some in the streets supporting two guns. There was an obstinate fight in the streets, lasting an hour, when the town was taken and eight or 10 of the best houses burned. The two guns and many small arms were captured and some prisoners taken, but all were abandoned when the return march was taken up next morning. The command reached Fayetteville on the 23d after a march of about 300 miles. The expedition had failed of its object, with the loss of 78 killed, wounded and missing, of whom 17 were killed, including Colonel Toland and two other officers. Colonel Powell, commanding the Second West Virginia cavalry, was severely wounded and captured. The Confederates report a loss of six killed and 12 wounded. On 2 May 1864 General Crook started from Charleston on the Kanawha to destroy the Virginia and Tennessee Railroad and join General Sigel in the Shenandoah Valley. One of his columns of 2,600 cavalry, under General Averell, was directed upon Saltville to destroy the salt works, and then rejoin the main column under Crook at Dublin Station. After a very difficult march through the mountains and some sharp skirmishing Averell reached Tazewell Court House on the afternoon of the 8th, where he learned that Saltville was defended by earthworks and artillery, and was held in strength by Gen. W. E. Jones, upon which he abandoned the idea of attack and turned toward Wytheville, near which he arrived on the afternoon of the 10th and encountered Col. John H. Morgan, who had followed him from Saltville and by a detour first gained the town with a brigade and two battalions. A detachment of Morgan's command had been pushed out to a small gap in the mountain, through which alone Averell could approach the town from the road on which he was marching. The detachment was immediately attacked and Morgan marched to its assistance with all his command, and Averell fell back to a commanding ridge 800 yards from the gap. The contest continued four hours, or until nightfall, in a succession of attacks on the one side and retreats on the other, when Morgan fell back a short distance and Averell withdrew and next morning marched for Dublin, where he arrived in the evening and, resuming his march, joined Crook at Union on the 15th. Averell had 114 killed and wounded and lost nearly 100 in prisoners. Morgan had 50 or 60 killed and wounded. When General Stoneman made his raid into southwestern Virginia in December 1864 he captured Wytheville on the 16th, partially burned it and next day sent a detachment to destroy the lead mines, which was done without loss. On Stoneman's second raid in southwest Virginia and western North Carolina in March 1865, Col. J. K. Miller, with 500 picked men of his cavalry brigade, captured Wytheville 6 April and destroyed the depot of supplies at that point and the bridges over Reedy Creek and at Max Meadows. At Wytheville, Miller was attacked by Confederate infantry and cavalry, but after hard fighting repulsed them, and withdrew with a loss of 35 killed, wounded and missing, and rejoined the main column on its march for Salisbury, N. C.

WYTTENBACH, vĭt'tĕn- bah, **Daniel Albert,** Dutch scholar: b. Bern, Switzerland, 7 Aug. 1746; d. Osgeest, Holland, 17 Jan. 1820. He studied at Marburg, Göttingen and Leyden; became professor of Greek at the Remonstrant Gymnasium at Amsterdam in 1771, of philosophy at the Athenæum in 1779, and succeeded in 1799 to Ruhnken's chair of rhetoric at Leyden. His greatest work is the edition of Plutarch's 'Morals,' with copious annotations and an admirable 'Greek Index to Plutarch's Works' (1795–1830). Other works are 'Epistola Critica' (1769); 'Praecepta Philosophiæ Logicæ' (1782; new ed., 1821); 'Eclogæsen Selecta Principum Historicorum Capita' (1793; 1829); 'Vita Ruhnkonii' (1800; Plato's 'Phædo' (1810; new ed. 1825). He retired in 1816, and died after some years of blindness. His 'Opuscula' appeared in 1820. Consult Mahne, 'Vita D. Wyttenbach' (1823) and Sandys, J. E., 'History of Classical Scholarship' (Cambridge 1908).

WYTTENBACH, Johanna Gallien, Dutch writer: d. Leyden (1830). She was married to D. Wyttenbach (q.v.) when he was 72, and after her husband's death lived at Paris and was given the degree of doctor in philosophy by Marburg, in 1827. Among her writings were 'Theagenes' (1815); 'Leontes' Banquet' (1812); and the romance 'Alexis' (1823).

X

X the twenty-fourth letter and nineteenth consonant of the English alphabet: it is a superfluous letter since it stands for no sound that cannot be signified by other letters. When it occurs in the beginning of a word it is always pronounced in English as *z: Xenophon, zenophon, xiphoid, ziphoid;* in the middle of a word it is usually equal to *ks: axis, aksis, Saxon, sakson;* but when in a word it ends a syllable, more especially an initial syllable, if the syllable following it is open or accented, the *x* has often the value of *gz*, as in *luxury, lugzury, exhaust, egzaust.* Final *x* is always equal to *ks.* As an initial letter *x* does not occur in English save in words mostly technical and derived from Greek, and in a few words, mostly proper names, of Spanish origin.— The power of *x* in English, as in Latin, is that of the Greek letter *xi* (Ξ ξ). It has been suggested that its form is that appropriated in the Greek alphabet to the guttural aspirate *chi* (Χ, χ). Before the introduction of *x* (ξ) the Greeks represented the sound of *x* by ΧΣ, χs and the Latins at first did the like, writing *Maxsumus, proxsumus;* but as *x* had in their writing no function but that of representing, with *s* the sound of Greek *xi*, the very sight of the *x*, even before the eye came to the *s*, may have raised in the mind the idea of a sibilant, and thus rendered the sibilant letter itself superfluous, so that before long it was omitted and *x*, standing alone, represented the two characters *x* and *s*. However, the evidence in favor of this view is not conclusive, and there are alternative opinions. In the popular pronunciation of Latin in the later period of the empire, *x* seems to have been sounded like *s* or *ss:* some inscriptions of that period have *visit* for *vixit*, and *milex* for *miles:* this change in the sound-value of *x* has persisted in the modern language of Italy in which *ss* or *s* is regularly substituted for the Latin *x: saxum* becomes *sasso, experimentum, esperimento, maximus, massimo* and so on. In French, in words derived from Latin, the *x* occurring in the middle of a word is often changed to *ss: laxare* becomes *laisser;* or Latin *x* is changed to the sound of *sh: vexare* becomes *facher;* and the word *soixante* is pronounced *soissante*. *X* scarcely occurs in German words of native origin; its sound is usually represented in that language by *chs*, examples: *ochs* (ox), *wachs* (wax), *Sachse* (a Saxon). *X* stands for 10 in the Roman symbolism; *x* is often used in mathematics for an unknown quantity or the abscissa of a point. See ALPHABET.

X-RAY, The, a ray proceeding from a glass-bulb from which air has been highly exhausted and through which an electric charge is being passed. It was discovered by Röntgen in Wurtzburg, 1895. Hundreds of others had experimented with Crookes tubes, glass bulbs exhausted to one millionth of an atmosphere and enclosing the terminals of high tension electric wires. These had all produced X-rays now called Röntgen rays, but Röntgen was the first to detect their presence. They are invisible and are supposed to be vibrations of a similar character to those of light but much more rapid than even the invisible ultra violet rays in sunlight. The extremely short wave length accounts for the fact that every substance regardless of its color is more or less transparent to the X-rays; and that the X-rays are not ordinarily reflected or refracted. In fact it was about 23 years after their discovery that it was found out that the cleavage surfaces of crystals, smoother than any artifically polished surface, would produce these two effects upon the X-ray which are so easily produced upon ordinary visible light. Excellent pictures are often taken through aluminum one-quarter inch thick, while denser substances like lead and gold arrest most of the X-rays even in much thinner layers. The modern X-ray tube contains a cathode or negative terminal from which the cathode stream of negative particles or electrons traveling at an average velocity of 20,000 miles a second starts under the influence of from 50,000 to 100,000 volts; also a target or anticathode upon which these particles impinge, setting up the extremely rapid vibrations called the X-ray or Röntgen ray. There is a positive terminal, the anode, which may or may not be used as the target. The gas filled X-ray tube contains air or some gas exhausted upon an air pump to a vacuum of about one-millionth of an atmosphere. It is provided with a regulator by which the degree of vacuum may be raised or lowered.

The electron discharge X-ray tube, such as the Coolidge tube, is exhausted to as complete a degree of vacuum as possible and even the highest voltage fails to send any electricity through it unless a low tension current is first sent through a tungsen filament forming part of the cathode. During the time that this filament is incandescent, it liberates electrons which are ready to form the cathode stream when the high tension current is turned on. Arrangements are necessary for regulating the strength of the low tension current so as to vary the incandescence of the tungsten filament.

The rays are made perceptible by looking through a fluoroscope or dark box enclosing a screen of some fluorescent substance like barium platino cyanide which becomes brilliantly illuminated. If the whole room is darkened the fluoroscope may consist simply of the flat screen. Anything held between the X-ray tube

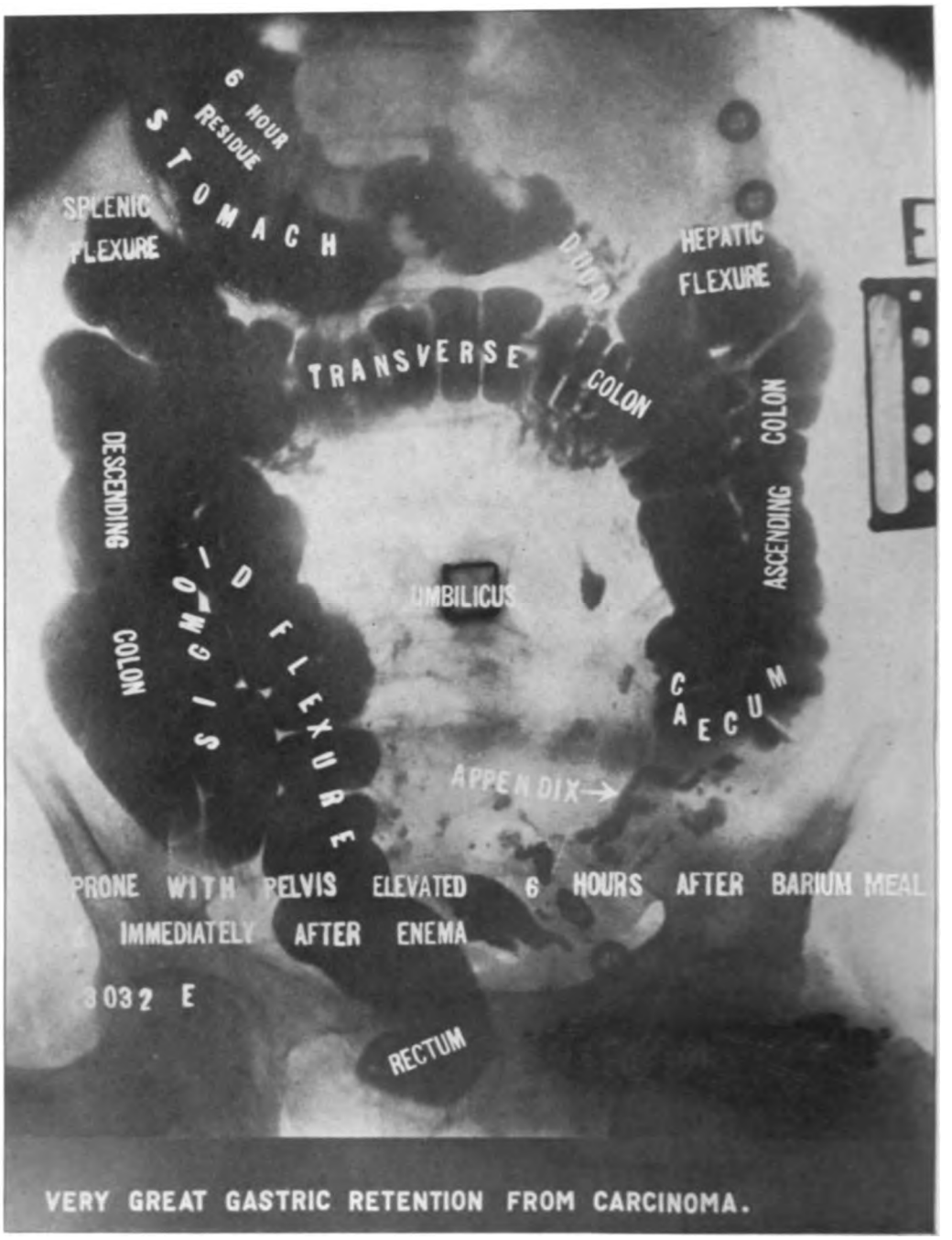
and the screen casts a shadow upon this illuminated surface and parts of the object which have different densities become distinguishable in the image upon the screen by reason of differences in the darkness of the shadow. Looking at a person's chest, the ribs look moderately dark and the lungs very light, while the heart is seen as a pale shadow expanding and contracting.

X-ray pictures are very often made without ever looking at the patient with the fluoroscope and not really seeing the part under examination, such as the bones of the leg, until the plate or film is developed. The latter is in a cassette or plate-holder made of aluminum which is opaque to ordinary light, but very transparent to the X-ray. Thin wood or thin hard rubber serve equally well. Or the plate may be simply wrapped in black and orange paper to protect it from ordinary light. No camera is required and the plate is not usually uncovered during the X-ray exposure. It is possible, however, to make an X-ray picture upon a completely uncovered plate providing the room is absolutely dark and the X-ray tube is surrounded by a covering opaque to ordinary light but transparent to the X-ray; it being desirable to protect the uncovered plate from ordinary light rays produced by the tube in addition to the X-rays.

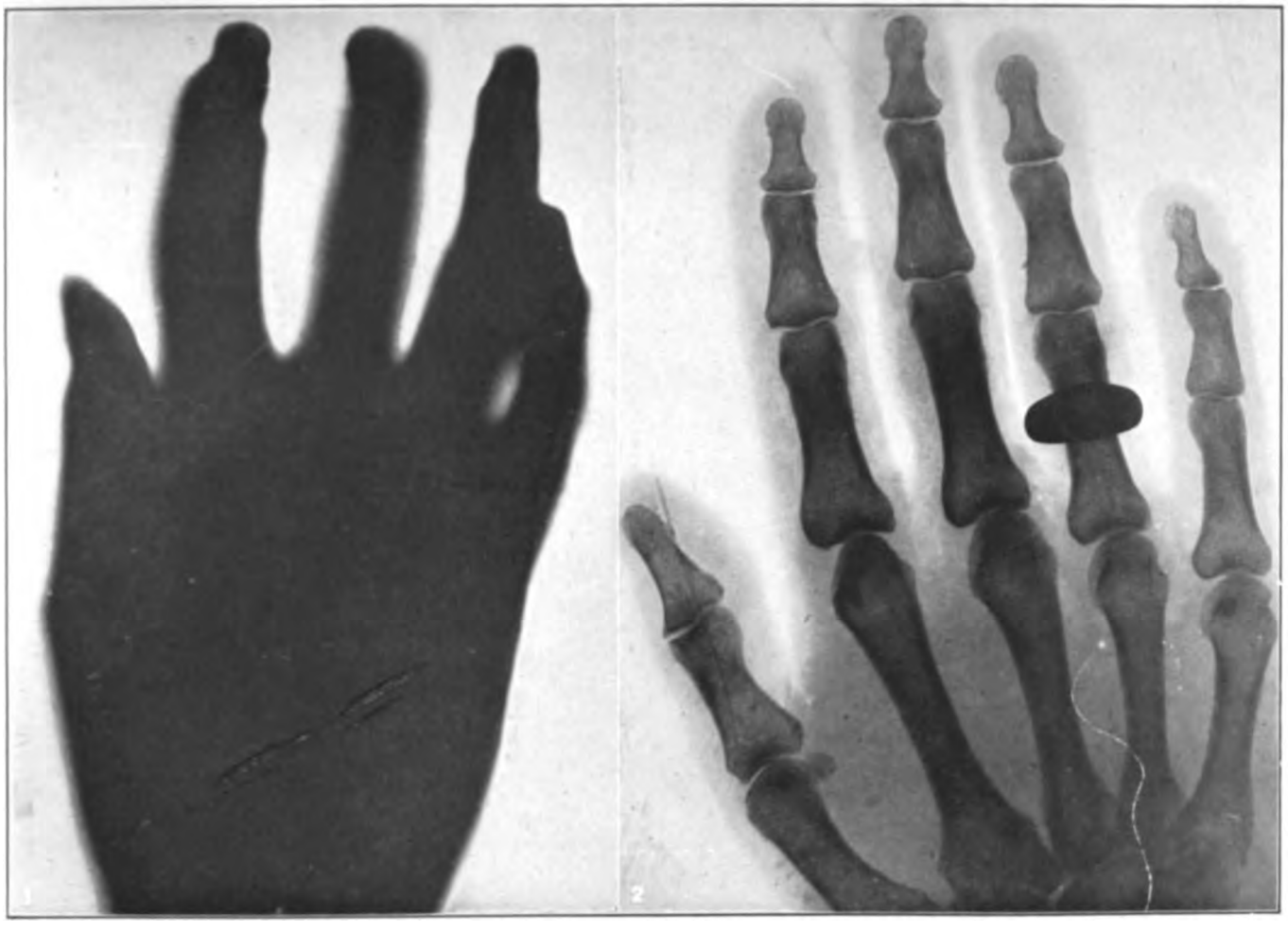
A special property of the X-ray is one also possessed by the rays from radium. It is that of ionizing the air and so rendering the air a conductor of electricity as may be demonstrated by the discharge of an electroscope. This property is made the basis of measuring the radio-active power of radium and has been occasionally used to measure the intensity or the dosage of the X-ray.

The X-ray is ordinarily made up of different rates of vibrations having as different properties as the different rates of vibration in ordinary light. X-rays of very rapid vibration are highly penetrating and are called hard rays; they are produced when the tube presents a high resistance to the passage of electricity and it takes a high voltage, perhaps 90,000, to send a current through the tube. This high resistance occurs when the vacuum of a gas-filled X-ray tube is high, that is most of the gas is removed; with an electron discharge X-ray tube like the Coolidge tube the resistance is high when the filament is at a low degree of incandescence. Rays of a low degree of penetration or soft rays are produced in greatest abundance by an X-ray tube whose resistance is so low that about 40,000 volts will send electricity through the tube. As a rule, the rays are not all of the same wave length, but the radiation is mixed. The average penetration is determined by the regulation of the resistance of the tube. Under special conditions, however, homogeneous X-rays are obtainable. The parallel spark-gap is the distance that the high tension current will pass across in the open air in preference to passing through the X-ray tube. It is frequently employed as a means of measuring the resistance of the X-ray tube. In a rough way, each inch of parallel spark gap corresponds to 10,000 volts of high tension current required to excite the X-ray tube and very roughly to one Benoist unit of penetration. Direct measurement of the average degree of penetration of the rays generated by an X-ray tube is generally by the Benoist Radiochromometer. There is a central disc of silver 0.11 millimeter thick, surrounded by sectors of aluminum from 1 to 12 millimeters thick. The number of millimeters of aluminum which cast a shadow of the same density as that of 0.11 millimeters of silver gives the degree of penetration. Soft rays are number three or four Benoist, and very hard rays number 10 or 12 Benoist. X-rays are partly absorbed by every substance through which they pass. The denser the substance and the softer the X-rays the greater proportion is absorbed by a layer of a given thickness. Very soft rays are so absorbable that even the petals of flowers cast shadows and produce beautiful pictures, while extremely hard rays are employed to look for flaws inside of steel rails. Medium degrees of penetration produce X-ray pictures of the human body in which the bones cast a darker shadow than the flesh, air spaces like the pneumatic sinuses of the face and like the lungs cast a lighter shadow and dense foreign substances like a bullet in a wound or an opaque meal in the stomach and intestines or a stone in the kidney cast dense shadows. Except in the case of a broken bone or a bullet, the interpretation of a radiograph requires a knowledge of the normal X-ray lights and shadows of the part depicted.

The effects of the X-ray upon the human body were first noticed as X-ray burns and loss of hair. Later it was found that these could be prevented and that the X-ray had marvelously beneficial effects upon cancer and leucæmia and tubercular glands and other diseases. Skin cancers are usually permanently cured without the necessity for an operation and moderately soft rays are employed which will be absorbed by the skin with very little deep effect. Deep-seated lesions require rays of great penetration so that a large fraction will reach the deep tissues. This is partly accomplished by regulating the X-ray tube to a high resistance so that it generates chiefly hard rays and also by interposing a filter between the X-ray tube and the patient. An eighth of an inch or more of aluminum will arrest many rays which would be absorbed by the skin with danger of burning, and which would greatly limit the quantity of the accompanying penetrating rays that could be safely applied. The intensity varies inversely as the square of the distance, so even rays of the proper penetration are much stronger at the surface toward the X-ray tube than in the deep tissues considerably further away. And even the penetrating rays are rapidly weakened by passing through the tissues. To secure sufficient effect upon a deep-seated organ without too much effect upon the skin a cross-fire system is necessary. One exposure is made shielding the skin with heavy lead except for an opening through which the X-ray passes to the deep organs. For another exposure, the person is in a different position and the X-ray reaches the same deep organ through a different part of the skin. Sometimes as many as eight different ports of entry are employed, the deep-seated organ receiving eight times the quantity of X-rays that could have been safely applied from a single direction. And so though the



Radiograph of the stomach and intestine in a case of cancer of the stomach



1 Radiograph of the Human Hand (Dead) Made by Radium

2 Radiograph of the Human Hand (Living) Made by X-Rays

X-ray is weakened by distance and by absorption in passing through the overlying tissues, a really beneficial total dosage is applied to the deep organ. All but the successive ports of entry must be shielded by thick lead. It is not sufficient to merely change the position of the X-Ray tube and the patient.

The cumulative effect of the X-ray is remarkable. A certain number of minutes exposure has the same effect whether applied at one time or in divided doses extending over two or three weeks. This is what makes it so dangerous to the operator if he is frequently exposed to the X-ray. Even though each exposure for a picture or treatment may be beneficial to the successive patients and although from the operator's being at a greater distance, he is exposed each time to a much smaller dose than any of the patients, the cumulative effect upon him is disastrous. Many X-ray operators have died from cancer originating from this cause. The only safety for the operator lies in being shielded from the rays by a brick wall or very heavy lead. An operator is very foolish to think that he is going to use the X-ray so seldom that he does not need to be shielded from it. If he does good work he will soon find that he has benefited many patients at the expense of irreparable injury to himself. The period of incubation is another interesting feature of the X-ray effect upon the human body. In treating skin cancers, a reaction is produced somewhat similar to a slight sunburn and this does not appear at the time of the exposure but all the way from four to 20 days afterward.

The dosage of the X-ray necessarily implies the appropriate quality as represented for instance, on the Benoist scale of penetration and also the appropriate quantity of X-rays measured usually as applied at the surface of the body. One unit of quantity is the Holzknecht unit H and about 5H is an erythema dose. Another unit is Tint B, Sabouraud, which is the same erythema dose. Another is Kienbock's X unit and 10X is an erythema dose. The erythema dose is that amount of X-ray which will produce redness of the skin without ulceration. It first became a standard of dosage in Sabouraud's treatment of ring worm of the scalp. In that disease the germs are difficult to kill because they are adherent to the roots of the hairs deep down in the hair follicles. A single erythema dose causes the hairs to fall out carrying the germs with them. Of course an antiseptic lotion must be employed to prevent reinfection of other hairs from those which have fallen out. After a single correct dose the disease is permanently cured and the hair all returns. Repeated doses of the X-ray are sometimes employed for the permanent removal of superfluous hair but not all authorities recommend this use of the X-ray.

The X-ray has led to one of the most important discoveries in modern medicine. It has shown that many diseases of the type of rheumatism, arthritis, neuritis and myositis, also endocarditis, digestive troubles including ulcer of the stomach and many other symptoms and lesions of a varied character frequently have their origin in tooth infection. A blind abscess may exist for years at the apex of the root of a tooth and poison the system all that time. It may give no pain or swelling and its presence may be unknown to the patient or the dentist and still be the cause of painful or even fatal illness. Such infection is readily disclosed by an X-ray examination and easily cured by the dentist. The patient is fortunate if this is done while the systemic infection is slight and of a nature to certainly get well after the discovery and elimination of the dental infection. Of course after the onset of a fatal illness is not the time to discover that it was caused by an infected tooth. There are almost always mild indications which suggest the desirability of an X-ray examination of the teeth in time to prevent the more serious effects of tooth infection. One of the effects of a great many mild exposures in the case of X-ray operators is sterility. This is an additional reason why the operator should be shielded. And one of the diseases in which X-ray exposures are curative is fibroid tumor of the uterus with hemorrhage as a serious symptom. The cases of this disease which are most successfully treated are those in which the X-ray exposures bring on an artificial menopause.

X-ray operators who are not shielded are liable to blood changes resembling anemia or leucæmia, but this effect is not so generally produced as the X-ray keratoses with a tendency to change into cancer, and the sterility.

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X. Y. Z. CORRESPONDENCE, in United States history, the name given to the dispatches of the three commissioners to France in 1797–98, Marshall, Pinckney and Gerry. These commissioners reached Paris in October 1797, but were refused recognition by the Directory. They were, however, notified by the secretary of the Marquis de Talleyrand, Minister for Foreign Affairs, that agents would be sent to conclude negotiations. The first of these, Hottinguer, stated that a "loan" of $1,200,000 would be the necessary means of placating the Directory: the other two, Bellamy and Hauteval, urged that in case the American government would buy at par stock amounting to 32,000,000 livres, but whose market-value was really about one-half that amount, the transaction would be viewed as a loan. The intimation was that in default of money war would ensue. These terms were promptly rejected. The dispatches sent by the commissioners were submittted in copy to Congress, X., Y., and Z., having been substituted for the respective names of the French agents. A great stir was caused at the time. Preparations for hostilities were made, and war on the sea actually broke out. Consult for the text of the correspondence 'American State Papers, Foreign Relations,' Vol. II (Washington 1832), also Adams, C. F., 'Works of John Adams' (10 vols., Boston 1850–56); Bassett, J. S., 'Federalist System' (Boston 1906), and Morse, J. T., 'John Adams' (Boston 1908).

XANTHENE DYESTUFFS. See COAL-TAR COLORS.

XANTHIAN (zăn'thĭ-ăn) **MARBLES**, a large collection of marbles of various ages (from 545 B.C. onward) discovered near Xanthus, in 1838.

XANTHINE, an organic base, $C_5H_4N_4O_2$, occurring in small amounts in many animal secretions, in the blood, urine, liver, in some urinary calculi, and in tea extract. It may be readily made by the action of nitrous acid on guanine. A white amorphous powder slightly soluble in water, and forming crystalline compounds with both acids and bases. It is closely related to theobromine and caffeine, the alkaloids found in cocoa and coffee respectively. Caffeine may be considered as xanthine in which three hydrogen atoms have been replaced by three methyl (CH_3) groups.

XANTHIPPE, zăn-thĭp'ē, the wife of Socrates, the Greek philosopher. Her shrewish temper has become proverbial, but many of the stories about her are probably false, for in ancient Athens gossip was cultivated to the perfection of a fine art, the point and not the truth of the story being the chief consideration. Xanthippe's natural inequalities of temper were heightened by the peculiarities of her spouse, especially his indifference to the common place duty laid on the head of the house to make both ends meet. The philosopher received her reproaches with such good-humored indifference that it is not surprising she sometimes resorted to other weapons beside her tongue; as on the occasion when she is said to have finished up a tirade by sousing the philosopher, though his remark, as he moved dripping from the scene, that when Xanthippe thundered she watered, must have shown her that here, too, she was powerless. Consult Zeller, E., 'Vorträge und Abhandlungen' (Vol. I, 1875).

XANTHOCONITE. A silver ore $3Ag_2S.As_2S_3$, containing 61.4 per cent of silver. Formerly mined in Santa Fé County, N. Mex.

XANTHUS, zăn'thŭs, Asia Minor, (1) an ancient city, the capital of Lycia, on the Xanthus River, about eight miles above its mouth. Its ruins near modern Gunik were discovered in 1838, and have yielded a large collection of marbles, now in the British Museum. (2) The river now known as the Kedja Ak rises in Mount Taurus, and falls into the Mediterranean a little to the west of Patara. Consult Behndorf and Niemann, 'Reisen in Lykien und Karien' (Vienna 1884); Smith, 'Catalogue of the Sculptures of the British Museum' (Vol. I, London 1892).

XAVERIAN BROTHERS. See ORDERS, RELIGIOUS.

XAVIER, zăv'ĭ-ĕr, Sp. hā-vĕ-ār'; **Saint Francis.** See FRANCIS XAVIER, SAINT.

XEBEC, zē-bĕk, a small three-masted vessel, employed in the Mediterranean, distinguished from other European vessels by the great projection of the prow and stern beyond the cutwater and stern-post. In this respect it resembles the felucca, from which it differs only in having the fore-mast square-rigged. The xebec is constructed with a narrow floor for the sake of speed, and of a great breadth, so as to be able to carry a considerable force of sail without danger of overturning.

XENIA, Ohio, city, county-seat of Greene County, on the Shawnee Creek, and on the Pennsylvania, the Cincinnati, Hamilton and Dayton, and the Chicago and Saint Louis railroads, 55 miles southwest of Columbus. It is in the Little Miami Valley, in the midst of a productive farming region. It is well laid out and has 11 miles of first-class pavement and a complete storm sewer system. The chief manufacturing establishments are shoe factories, powder works, an ice factory, a flour mill, twine factories, cigar factory, machine shops, one automobile factory, saw and planing mills, marble and granite works, canneries, candy kitchens. The county courthouse is in a park in the centre of the city. Other prominent buildings are the municipal building, the Ohio Soldiers and Sailors' Orphans Home and several business blocks. Outside the city limits are the county infirmary and children's home. The educational institutions are the Xenia Theological Seminary (United Presbyterian), opened in 1794; three high schools, the Central, established in 1850, one for colored pupils, and the Ohio Soldiers and Sailors' Home High School; public and parish schools, a public library and school libraries. Wilberforce University, in Wilberforce suburb, is for colored pupils. It has departments of law, theology, science and literature, and a training school for nurses. There are several churches. The banks have a combined capital of over $250,000, and ottal resources about $2,400,000. The government is vested in a commission of five and a city manager. Xenia was settled in April 1803 by John Marshall. In 1808 it was incorporated. Pop. 8,711.

XENOCLES, zĕn'ō-klēz, Greek tragic poet b. Athens, 4th century B.C., in the time of Philip of Macedon. He obtained a prize for four plays, 'Œdipus,' 'Lycaon,' the 'Bacchantes,' and 'Athamas.'

XENOCRATES, zē-nŏk'rą-tēz, Greek philosopher: b. Chalcedon, 396 B.C.; d. 314 B.C. He was a pupil and friend of Plato, and though of a dull and sluggish disposition, supplied the defects of nature by unwearied attention and industry. He succeeded Speusippus in the school of Plato about 339 B.C., presiding over the academy till his own death 25 years later. He was famed for his integrity and it is said that when he appeared in the court as a witness the judges dispensed with his oath. His philosophy followed the teachings of Plato but was modified by Pythagorian tendencies. He measured the value of philosophy and ethics according to their effect upon conduct; and while not a great or original thinker, his personal influence, through his purity and integrity, was enormous. He converted Polemon from dissolute habits to a life of high and pure purpose. Among his followers were Phocion, Chaeron, Zeus and Epicurus. He was the author of numerous works, none of which, however, are extant.

XENOLITHS, inclusions of the wall rock caught in an intrusion, as in a dike (q.v.), sill (q.v.), or batholith (q.v.); and there frozen into the igneous mass as it cools. See MAGMATIC STOPING.

XENON, a gaseous chemical element discovered by Ramsey and Travers (1898) in the residue left after the evaporation of a large quantity of liquid air. It is the heaviest of the elementary substances present in the atmosphere in gaseous form. It can be condensed to a liquid boiling at 109° C., and to a solid which volatilizes without melting. Its volume in atmospheric air is about one in 170,000,000. Sym-

bol X or Xe; atomic weight 130.2. It is an inert chemical element having a spectrum somewhat resembling argon.

XENOPHANES, zē-nŏf'ą-nēz, Greek philosopher and poet; founder of the Eleatic school of philosophy; b. Colophon, Asia Minor, about 570 B.C.; d. about 480 B.C. He was a contemporary of Pythagoras and Anaximander, and having been banished from his native city, went to Sicily, and thence to Magna Græcia. He settled, about 536 B.C., at Elea (Velia), whence his system, and the school which he founded, derive their name. Of his poems, in which he treated of philosophical and other subjects, only fragments are preserved in the works of Athenæus, Plutarch and others. The portions of his didactic poem, 'Peri physeos' (On Nature) have been collected by Brandis in his 'Commentationes Eleaticæ' (1813), and by Karsten in his 'Philosophorum Græcorum veterum reliquiæ' (Vol. I, 1830). He was an ardent monotheist and declared that Homer and Hesiod attributed actions to the gods that were "a shame and a reproach among men." Consult Ueberweg, 'History of Philosophy,' English trans. (1872); Zeller, 'Philosophie der Grieschen,' 4th ed. (1900). See ELEATICS.

XENOPHON, zĕn'ō-fŏn, ancient Greek historian and general; b. Athens, about 434 B.C.; d. Corinth, about 355 B.C. He lived during a period in which the greatest political and intellectual excitement existed at Athens, and in which the most distinguished men, of whom he was one, appeared on the stage. Xenophon was a disciple of Socrates. He was said to have fought with his teacher in the Peloponnesian war, and to have had his life saved by Socrates in the battle of Delium (424 B.C.), but this is not now accepted. When the Persian prince, Cyrus the Younger, contended with his elder brother Artaxerxes Memnon for the throne, the Lacedæmonians sent him auxiliaries, among whom Xenophon served as a volunteer. Cyrus was defeated and lost his life on the field of Cunaxa (401 B.C.). The principal officers of the auxiliary army having been likewise killed in battle, or taken prisoners by artifice, and then put to death, Xenophon was apparently selected to command the Greek forces, 10,000 men strong. They were in a most critical situation, in the midst of a hostile country, without cavalry, surrounded by enemies and innumerable difficulties; but Xenophon was able to inspire them with confidence, to repress insubordination, and to lead them in their return march of 1,500 miles to the Black Sea. Xenophon himself has described this retreat, and at the same time the whole expedition of the younger Cyrus, in his 'Anabasis,' the most famous of military narratives. There is no means of verifying the statements of this work. On their arrival at Chrysopolis (opposite Byzantium) a number of the troops, with Xenophon at their head, entered the service of Seuthes, king of Thrace. Later, Xenophon joined the Spartan general Thimbron or Thibron, who was then conducting the war against the Persian satraps, Pharnabazus and Tissaphernes. There is no reason to believe that Xenophon left Asia Minor before 394, when he returned to Greece with Agesilaus, king of Sparta, after his expedition against the Persians. In that year he fought on the side of the Spartans against the Athenians at Coroneia. As a consequence he was found guilty of high treason and exiled. After that he settled at Scillus, a small town in the neighborhood of Olympia, in Elis. In this solitary retreat he dedicated his time to literary pursuits; and as he had acquired riches in his Asiatic expeditions, he began to adorn the country which surrounded Scillus. He built a magnificent temple to Artemis in imitation of that of Ephesus, and spent part of his time in rural employments, or in hunting in the woods and mountains. He does not appear ever to have returned to Athens, although the sentence of banishment passed on him was afterward repealed. He remained for about 20 years at Scillus, but was ultimately expelled from it (371 B.C.) by the Eleans. Thereupon he retired to Corinth, where he died. Besides the 'Anabasis,' Xenophon wrote the 'Apomnemoneumata,' more commonly known as the 'Memorabilia Socratis,' in which there is no doubt that we have a faithful representation of the moral and practical side of the Socratic teaching, although he makes no attempt at interpreting its metaphysical aspects; the 'Cyropædia,' in which, under the guise of a life of Cyrus the Elder, there is an exhibition of Xenophon's views respecting the best form and methods of government; the Symposium' (Banquet), in which Socrates is brought before us under his social aspect; the 'Hellenica' which continues the history of Thucydides, and which, while open to criticism for its political bias, is nevertheless honestly written and is highly valuable as the only contemporary account of the period 411–362 B.C.; and of several minor works on hunting, agriculture, politics and the science of war, all of great interest as giving an authentic presentation of the ordinary life of the Greeks of that period. The style of Xenophon is in general a model of simplicity. The Greeks esteemed his merit as a writer so high that they called him the "Attic bee" and the "Attic muse." Later criticism has found that in both vocabulary and syntax he frequently deviates from the best Attic usage. His works have been often published separately and together. Among the best editions of the complete works of Xenophon are those by Schneider and others (1791–1849), Sauppe (1865), and Dindorf (1875). There is a complete English translation by H. G. Dakyns, with introductions and notes (1890–93). Consult also the studies by Croiset (1873), Roquette (1884), and Lange (1900); Bury, J. C., 'Ancient Greek Historians' (1909); Wright, W. C., 'A Short History of Greek Literature' (1907).

XENOPHON OF EPHESUS ("XENOPHON THE YOUNGER"), Greek writer who flourished in the 2d century A.D. One work of his has been preserved, a story in five books, called 'Ephesiaca; or The Loves of Abrocomas and Anthia.' The story is written in a style simple and elegant. It was translated into English by Rooke,—and into German by Bürger.

XENOS, zē'nŏs, Stefanos Theodoros, Greek author. From 1855 he was a merchant and general broker in London, and in 1858 was naturalized as a British citizen. He published 'The Devil in Turkey' (1850), a three-volume English translation from the author's unpublished Greek manuscript; in Greek, 'The Heroine of the Greek Revolution' (1861), trans-

lated as 'Andronike' (1897); 'East and West: A Diplomatic History of the Annexation of the Ionian Islands to the Kingdom of Greece' (1865); and 'Depredations: or Overend, Gurney and CoC. and the Greek and Oriental Steam Navigation Company' (1869).

XENOTIME, a tetragonal mineral occurring in crystals of the same forms as zircon. It is essentially an yttrium phosphate, YPO_4, but much erbium is frequently present, and also sometimes the cerium metals, and small quantities of thorium and silicon. It is usually found in minute crystals of resinous or vitreous lustre, yellow or brown color and having a hardness of 4 to 5 and specific gravity of about 4.5. It occurs as an accessory constituent in many granites (see Derby in *American Journal of Science* 41, 308, 1891), in large crystals in the granitic rocks of Norway, in the auriferous gravels of North Carolina and Georgia, and in choice crystals in the gneiss of New York City. When obtainable in sufficient quantities it will be an important ore of yttria and erbia.

XERES, hā'rās, or **XEREZ,** or **JERES, Francisco de,** Spanish historian: b. Seville, about 1500; date of death unknown. He accompanied Pizarro, as his secretary, to Peru, about 1530, returned to Spain with the first shipment of gold taken from Atahualpa. At the direction of Pizarro he wrote a detailed history of the expedition and the conquest down to the death of Atahualpa, entitled 'A True Account of the Conquest of Peru' (1547). The work was translated into Italian by Ramusio, and into French by Ternaux-Compans and is still valued as a source of information.

XERES DE LA FRONTERA. See JEREZ DE LA FRONTERA.

XEROPHYTES, zĕr'ō-fīts, plants which have guarded themselves by structural means against excessive transpiration. The term was originally applied to plants living in dry and sandy soil, or on rocks, and to those inhabiting deserts; but it is now extended to plants existing in localities where, for one reason or another, they cannot readily obtain water, as in the case of the vegetation in salt marshes, arid bogs and moors and of cold regions where water is present but not available for the use of the plants, which have consequently adapted themselves to prevent the waste of the moisture which they have. This result is obtained in various ways. In some, the transpiring surface is greatly reduced, and the foliage is nearly or wholly dispensed with, the stems themselves taking its place, as in switch plants and cacti; and this habit is frequently combined with the storage of water in succulent tissues. Other plants, like the eucalyptus trees predominating in the dry forests of Australia, by a vertical arrangement of their foliage, or a similar disposition of the branches themselves, when foliage is wanting, as it is in the casuarinas, avoid presenting broad surfaces to the sun and hot winds. Some erophytic plants close their leaves just before the dry season; the whole existence of others begins and ends during the continuance of a rainy season; and in the bulbous and tuberous plants we see still another common arrangement for passing the dreaded dry months, the plants growing vigorously and completing their above-ground existence, while the weather is still favorable, and storing up food in their roots or rootstocks, so that they may rest uninjured in the ground during the heated term, and be ready to spring into activity as soon as the rains begin. An extensive development of ligneous tissue is characteristic of xerophytes and so also are such modifications of tissue as the matted hairs, mineral waxy and varnish-like encrustations on the epidermis, the closing or concealing of stomata, etc.

XERXES I, zĕrk'sēz, king of Persia: b. about 519 B.C.; d. 465 B.C. He was a younger son of Darius, the son of Hystaspes, and began to reign in 485. He was preferred to his elder half-brothers, born before his father was raised to the throne; Xerxes was born after that event, and was the son of Atossa, daughter of Cyrus. After having suppressed a revolt in Egypt in a single campaign, he thought himself able to execute the plan of conquering Greece, already conceived by his father, and collected for this purpose an immense army, estimated by the historians as containing 1,000,000 men. In all probability the Greeks greatly exaggerated the number of their enemies; and the train of women and slaves who followed the army made at least half of its numerical amount; still the numbers of the Persians were beyond all comparison superior to those of the Greeks. By means of a bridge of boats Xerxes crossed the Hellespont (480) while the Greeks awaited him on the frontier of their country, in the pass of Thermopylæ. After the heroic Leonidas had fallen with his Spartans (see LEONIDAS), Xerxes burned Athens, which had been forsaken by its inhabitants. The first naval battle between the two powers at Artemisium had been indecisive; but it inspired the Greeks with new confidence; and the second naval action at Salamis, in which, if we believe the Greek historians, 2,000 Persian vessels were engaged against 380 Greek, terminated in the defeat of the Persians (28 Sept. 480). Xerxes now quitted Greece, leaving behind him his best general, Mardonius, who, not long after, was routed at Platæa. Xerxes now gave himself up to debauchery; his conduct offended his subjects and Artabanus, the captain of his guards, conspired against him and murdered him in his bed. The personal accomplishments of Xerxes have been commended by ancient authors; and Herodotus observes that there was not one man among the millions of his army that was equal to the monarch in comeliness or stature, or as worthy to preside over great and extensive empire. He was succeeded by his son Artaxerxes I.

XIMENA, hē-mā'nā, in Spanish legendary history, the wife of the Cid (q.v.).

XIMENA, or The Heroic Daughter, an English adaptation of Corneille's 'Cid,' by Colley Cibber, first played in London in 1712 and printed in 1718.

XIMENES, zi-mē'nēz, Sp. hē-mā'nās, or **JIMENES** (or **XIMENES**) **DE CISNEROS, Francisco**, Spanish ecclesiastic, prime minister and regent: b. Torrelaguna, Castile, 1436; d. Roa, near Valladolid, 8 Nov. 1517. He was graduated in civil and canon law at Salamanca in 1456, became a priest and going to Rome practised in the courts of the consistory 1459–65. He obtained a papal bull, which secured to him the first vacant benefice in Spain, but the archbishop of Toledo refused to give him any place, and, Ximenes having taken possession of a vacant benefice, the archbishop caused him to be imprisoned. Ximenes, nevertheless, recovered his freedom and the Cardinal Gonzalez Mendoza, bishop of Siguenca, appointed him his grand-vicar. He entered the Franciscan order in 1482, and for several years practised the most rigid asceticism. In 1492 he became confessor to Queen Isabella of Castile, to whose notice he had been recommended by Cardinal Mendoza, and in 1495 was made archbishop of Toledo. He did not accept this dignity till after many refusals, and an express command from the Pope. As an archbishop he was very zealous, behaving as a father toward the poor, abolishing a multitude of abuses, and adhering steadfastly to his resolution that public offices should be filled with honorable and well-qualified men. In spite of all opposition he effected a reform in the mendicant orders of Spain, founded in 1499 a university at Alcala de Henares, and undertook in 1502 the Complutensian Polyglot Bible. His activity was also displayed in other ways. Dissensions prevailed in the royal family. Philip of Austria, son of the Emperor Maximilian I, had married Joanna, the only daughter of Ferdinand and Isabella, and on the death of the latter Philip received Castile, in right of his wife, the sole heiress of her mother. This gave rise to disputes between him and his father-in-law, which were composed by Ximenez. After Philip's death (1506) Ferdinand became regent of Castile for his grandson, afterward the Emperor Charles V, who was a minor. On this occasion he had been much assisted by Ximenez, who in 1507 was made cardinal and grand-inquisitor of Spain. The conversion of the Moors now particularly occupied his attention. With this view he formed the project of passing over to Africa, in order to take the fortress of Oran, and in May 1508, landed on the coast of Africa. A battle soon followed in the neighborhood of Oran, in which the Moors were defeated. The fortress was immediately taken and the garrison put to the sword. Ximenes caused Oran to be fortified anew, changed the mosques into churches, and returned as a conqueror to Spain. When Ferdinand died in 1516, his grandson Charles being still a minor, Ximenes became regent of Spain and during his regency of two years brought the finances into order, paid the crown debts and restored the domains which had been alienated, caused the laws to be observed, and placed the Spanish military force upon a respectable footing. Consult Fléchier, 'Histoire du Cardinal Ximenes' (1693); Hefele, 'Der Kardinal Ximenes' (1844; English trans 1860); Barrett, 'Life of Cardinal Ximenes' (1813); Prescott, 'Ferdinand and Isabella' (1838); 'Life,' by Ulrich (1883).

XIMÉNEZ DE QUESADA, dā kā sā thā, **Gonzalo**, Spanish explorer and conqueror: b. Granada, about 1498; d. Mariquita, New Granada, 16 Feb. 1579. He came to America in 1535 as a judicial functionary in the suite of Pedro Fernández de Lugo, governor of the province of Santa Marta, who chose him to head an expedition against the Chibchas, supposed to number more than 2,000,000 souls, on the great plains of Tunja and Bogotá, and the neighboring regions about the head-waters of the river Magdalena. He set out 6 April 1536 from Santa Marta, but at the end of eight months had made no more than 450 miles. After great hardships the expedition reached the mountains and in the following March progress was resumed.

The first Indians he met were so terrified by the sight of his horses that they instantly submitted. Approaching at Tunja the court of one of the great chiefs of the Chibchas, he was allowed to enter the palace, but was treacherously attacked as he was about to embrace the chief. The latter was taken, after much slaughter, and Ximénez became possessed of vast riches. From Tunja he marched upon Iraca, the sacred city of the nation. Here two Spanish soldiers, in pursuit of plunder, accidentally set fire to the great temple of the sun, which had been captured by Ximénez, and it perished with the city after burning several days. Returning toward Tunja, he fought a desperate battle at Borja against 12,000 natives, whom he defeated, after which he made treaties with several caciques, who voluntarily submitted. A usurping chief was then proclaimed king; but was required to deliver the treasures of his predecessor to the Spaniards. After a short imprisonment he promised within 40 days to fill a room with gold and emeralds, but not keeping his promise, was put to death with cruel tortures. On 6 Aug. 1538 Ximénez founded the city of Santa Fé de Bogotá.

He was presently joined by Benalcazar, the lieutenant of Pizarro, and Federmann, who presently conspired against Ximénez but without much success. The three then returned to Europe to lay their claims before Charles V, but while Benalcazar was made governor of Popayán, Federmann and Ximénez gained nothing. Later, however, Ximénez was made marshal of New Granada and returning to Bogotá in 1551, seems to have protected the people against the rapacity of Spanish officials. About 1561 he was named by the Spanish government *adelantado*, or governor-in-chief of the kingdom of New Granada, and induced to fit out an expedition in search of El Dorado, beyond the territories of Pauto and Papamene. To this enterprise he devoted three years, spending immense sums in fitting it out, but returning with only a handful of followers. In 1572 he founded the city of Santa Agueda, 21 miles from Mariquita. He died of leprosy and by his will declared himself poor and forbade the erection of any but the simplest monument over his grave. His remains were removed to Bogotá in 1597. He left a manuscript work entitled 'Sermones' and a 'Compendio historial,' both of which have been

lost. Consult Acosta, J., 'Historia del descubrimiento y colonización de la Nueva Granada' (1849); de Plaza, Antonio, 'Memorias para la historia de la Nueva Granada' (Bogotá 1850).

XIMENIA, a genus of plants of the family *Olacaceæ*, represented by large shrubs or small trees, often spiny. Leaves entire, leathery; calyx very small, petals four, hairy inside; stamens eight; ovary with four one-seeded cells. *X. americana*, the false sandalwood, is a straggling shrub, or low spreading tree producing dull-white fragrant flowers, smelling like cloves, succeeded by small, oval, red or yellow pulpy fruits, an inch long, aromatic, but somewhat astringent. They contain a white globose nut with a kernel which tastes like a filbert. Its wood is very tough and heavy. This shrub is known in Florida as the hog-plum or wild lime, and in the West Indies as mountain or seaside plum.

XINGŮ, shĕn-goo', a river of Brazil, one of the chief tributaries of the Amazon. It is formed by the junction of several head-streams which rise near Lat. 15° S., Long. 55° W. Chief of these is the Tamitatoaba, which flows from a small lake about 75 miles in circumference. After flowing north for 1,200 miles through a densely forested and little explored region, the Xingu forms a large lake which is connected with the Amazon estuary by a number of deltaic channels 240 miles west of Pará. Steamers ascend the river to the Cataract and Fall of Itamaracá. The river was unexplored until 1884–87, when it was descended from Cuyabá by Von den Steinen.

XIPHODONTIDÆ, zĭf-ō-dŏn'tĭ-dē, a family of primitive forerunners of the ruminants, whose remains occur in the Upper Eocene rocks of western Europe. Some of them are the largest and most slender artiodactyls of their age, and the only feet hitherto discovered are two-toed, with mere rudiments of the lateral digits. See Oreodonts.

XIPHOSURA. See Horse-foot Crab; Merostomata.

XUARES, hoo-ä'rās, **Gaspar**, Paraguayan botanist, historian and biographer: b. Santiago del Estero, Paraguay, 1731; d. Rome, Italy, 1804. Entering the order of Jesuits, he devoted himself to teaching philosophy and theology; and after the suppression of his order he removed to Italy, where he occupied himself with botanical researches. He wrote 'History of Buenos Ayres,' and 'Dissertations,' which remain in manuscript; 'Life of Saint Francis Xavier,' etc.

XULLA, shool'lä, or **ZORELLA ISLANDS**, East Indies, a group in the Molucca Sea, south of the Molucca Passage, and east of Celebes. The largest islands of the group are Taliabo, Mangola, and Xulla Besi. The first is about 60 miles long and 15 miles wide.

XUREL. See Horse-mackerel; Jurel.

XYLANDER, ksĭ-lăn'dĕr, **Guilielmus**, German scholar: b. Augsburg, 20 Aug. 1532; d. Heidelberg, 10 Feb. 1576. His real name was Wilhelm Holzmann. He was educated at Tübingen and Basel and in 1558 was appointed professor of Greek at Heidelberg. His numerous Latin translations from the Greek have been of much service to later students.

XYLENE, or **DIMETHYL BENZENE**, *in chemistry*. Three isomeric hydrocarbons are known by this general name, orthoxylene, metaxylene, and paraxylene. They all have the composition $C_6H_4(CH_3)_2$ and are dimethyl derivatives of benzene. Commercial xylene or xylol, found in coal tar, is a mixture of the above three. It is a colorless, oily liquid, boiling above 140° C., not soluble in water, and used as a solvent in various chemical operations.

XYLOGRAPHY. See Wood Engraving.

XYLOIDIN, or **XYLIDINE**, *in chemistry*, an explosive probably of the composition $C_6H_7NO_2O_4$, known also as pyroxylam and nitrostarch. Discovered by Braconnet in 1833 and prepared by dissolving one part of potato starch in eight parts of fuming nitric acid and then pouring this solution, well cooled, into 16 parts of concentrated sulphuric acid. It is a white hydroscopic powder, insoluble in water and alcohol, but soluble in ether. It is not used to any considerable extent.

XYLOPHONE, a musical instrument of percussion consisting of bars of wood or glass graduated in length and resting on belts. The notes are produced by striking on the bars with small hammers and have a range of two or three octaves. Called also "aigelira," "sticcada," and "straw-fiddle."

XYLOPIA, a genus of anonaceous trees or shrubs, natives of tropical regions, with coriaceous leaves, commonly two-ranked, and flowers in axillary clusters or solitary. The corollas have six petals, the outer three elongated, boat-shaped, curving over and partially enclosing the other three. The receptacle is conical, with the stamens outside and the carpels in its excavated interior. The fruits are elongated berries. *X. sericea*, the pindaïba of Rio Janeiro, bears a highly aromatic fruit, which may be used as pepper, with which it agrees in flavor. Good cordage is made from the fibres of its bark. The wood, bark and berries of *X. glabra*, the "bitter wood" of the West Indies, taste like orange seeds, and impart a similar flavor to the wild pigeons which feed on them. It is said to be useful in colic and for creating an appetite. Martius believes the fruit of *X. grandiflora* to constitute a valuable febrifuge used by the South American Indians. The dry, black and quill-like fruits of *X. aromatica* form the *Piper æthiopicum* of commerce, used as pepper by the West African negroes. They are sold in the native market as a stimulant and condiment. *X. polycarpa* is the yellow dye-tree of tropical Africa, with a bitter bark, that contains berberine and which yields a yellow dye, of extensive use; it is also employed for the treatment of bad ulcers.

Y

Y the 25th letter of the English alphabet, derived from the Greek through the Latin, is both vowel and consonant. It came into Latin in Cicero's time in spelling words borrowed from the Greek; for the Latin language has no sound like that of the Greek Υ (upsilon); the *y* found in some Latin words, as *lacryma, satyra, sylva*, is due to an error of modern editors; those words were in ancient Latin always written *lacrima, satira, silva*. The modern Italian alphabet has no *y*, and the *y* of Greek words adapted into Italian is changed to *i*: *sinfonia, symphony, sindico, syndic*. In Dutch, *y* stands for *ij*, and represents the diphthonal long *i* of English as in *time*. In English, *y* is a superfluous letter, so far as it stands for a vowel sound; as such, it can always be represented by the vowel *i*. The sound of Υ, *v*, in Greek, was that of French *u* and German *ü*. This sound does not exist in English: it is heard when, with lips and tongue in the positions for pronouncing the vowel sound *oo*, one tries to give the English vowel sound of *e* in *he*. In early English or Anglo-Saxon, *y* represented this peculiar vowel sound; but it has so far dropped out of English speech that a person whose only speech is English cannot pronounce it untaught. At the time of the Norman Conquest *i* had taken the place of this *y*, and soon both the sound and the letter went out of English use. But when Norman words came to be used by the English the French *u* sound was retained in many words, as *muse, lute, duke*, and they were pronounced with the French *u*; this sound gradually developed into *iu*, but the spelling remained unchanged: this *iu* represents the sound of *u* in *muse, duke* as now pronounced. In the beginning of syllables and when followed by a vowel, *y* is a palatal consonant formed by bringing the middle of the tongue in contact with the palate, nearly in the position for *g* hard; hence Old-English *g* hard has often been softened into *y*, as in *day* from Old-English *dag*. *Y* also often stands for the sound pronounced in the same manner but written *j* in the other Germanic tongues. Until comparatively recent times it was customary to write *the* y^e^ and *that* y^t^, and those forms were repeated in typography. In those cases the character resembling *y* or identical with it, stood, not for *y* but for the Old-English letter Þ: it is a mere ignorantism to read "ye year," *ye year* as though *y* here stood for the consonant *y*, and not for the digraph *th*. As an abbreviation *Y* stands for yttrium. *Y* is used in mathematics for the second of two unknown quantities or the ordinate of a point in Cartesian co-ordinates. See ALPHABET

YACHTING RECORDS. See SPORTS.

YACHTS AND YACHTING. A yacht, as distinguished from a boat or ship, is a vessel designed for pleasure, not commerce, usually built for both comfort and speed, and often luxuriously equipped. It may be either a sailing vessel of one, two or more masts, or a steam or gasoline-power craft. Small, very swift pleasure craft, with gasoline power, are called motor-boats, and slow-going but more or less well-cabined boats for shore and private use are house-boats (q.v.). Yachts are further distinguished from merchant vessels in that they are free to go between coast ports without registering at a custom house, although in going to a foreign port registration is usually required. Visiting yachts of other countries are commonly extended the privileges granted to local yachts.

English Yachting.— The word *yacht* is of Dutch origin, being from the Dutch *jagt*, a swift vessel, from *jagen*, to chase, to hunt. It seems to have been introduced into England in 1660 when the Dutch presented Charles II with a yacht. The first recorded yacht race was between Charles II and his brother, the Duke of York, which took place on the Thames in 1661, but from that date none is on record till 1796, when 10 boats started on a 50-mile race in the Bristol Channel under the auspices of the Bristol Sailing Society. For a long period, extending well into the 19th century, yachting was closely connected with naval defense, and private yachts were generally constructed to carry guns and to be used in case of need for naval purposes. Private individuals of means were thus able to contribute to national defense not only directly by forming a kind of minor volunteer fleet, but also indirectly by leading the way in the development of naval architecture. In 1832 the *Emerald*, the fastest cutter in the Royal navy, was defeated in a racing and sailing contest with the *Paddy from Cork*, a yacht belonging to a member of the famous Water Club of Cork, and in consequence the head of the government school of naval architecture in Portsmouth was deputed to measure several private yachts with a view to improving the construction of vessels for the navy. In the following year the *Water Witch*, a vessel similar to the 10-inch gun brigs of the navy, built for Lord Belfast, proved herself faster than any vessel in the Royal navy, and better than any of her kind for purposes of warfare. Of the many yacht clubs now in existence only the Royal Cork Yacht Club and the Royal Thames Yacht Club can trace their history back to a period before the last century. While the modern yacht clubs have promoted a vast number of sailing races, wealthy yachtsmen have come to own numerous steam pleasure yachts devoted to summer cruising. The premier yacht club of Great Britain, the Royal Yacht Squadron, with headquarters at Cowes, dates back to 1815 in its formal capacity. In 1820 it

became the Royal Yacht Club, and in 1833 its name was changed by royal order to Royal Yacht Squadron. The Royal Northern Yacht Club, with headquarters at Rothesay, was founded in 1824.

In 1909 Lloyds Registry of yachts showed a total of 2,250 craft, of which 1,443 belonged in the United Kingdom, 137 were colonial, 182 French, 86 German and Austrian, and other countries totaled 332. The United Kingdom tonnage totaled 190,000, the French 6,745, the German and Austrian 6,602, the other countries about 72,000. Perhaps the most elaborate steam yacht was the *Hohenzollern*, the private yacht of the former kaiser. There was a marked increase in 1915, the last year before the war changed conditions. In that year the English, French, Continental and colonial yachts registered in Lloyds showed 10 of from 2,000, to 5,000 tons, 33 from 1,000 to 2,000 tons, 71 from 500 to 1,000 tons, 535 from 100 to 500 tons and 3,125 below 100 tons; total, 3,774 craft. The number of yacht clubs in Great Britain at the same date was nearly 200. With the coming of the Great War and the U-boat campaign, British and Continental yachting were almost forgotten. Races ceased and the larger and finer steam and pleasure yachts were loaned or sold to their respective governments. The typical sailing racers are of little practical use, but the steam pleasure yachts made splendid dispatch boats and were also useful for hospital purposes.

Among pioneer British sailing yachts of the first half of the 19th century the most notable were the *Menai*, in which the hollow bow was first introduced; the *Mosquito* (1848), an iron vessel built on the Thames in accordance with Scott Russell's theories; and the *Tiara*, built at Renfrew in 1850. The victory of the *America* from the United States in 1851 marked an epoch in British yachting. It secured the triumph of the views represented in the *Mosquito* and the *Tiara* and revolutionized the practice of British yachtsmen. For about a quarter of a century the schooner was the popular form of racing yacht, among the most notable being *Cambria* and *Miranda*. Gradually the schooners were displaced by cutters and yawls. The more famous of the early racing cutters were *Kriemhilda, Oimara, Cythera, Volau-Vent* (1875) and *Neva* (1876); and the leading yawls of that period were *Florinda* (1873) and *Jullanar* (1877). *Formosa*, a big cutter built in 1878, was supreme in her class till 1880, when G. L. Watson's first large yacht, the *Vanduara*, came on the scene. Another famous designer, Mr. Fife, scored a great success with the 40-ton yacht *Annasona*, which began to compete in 1881. *Marjorie*, from Watson's lines, a vessel of 68 tons, was the chief new cutter of 1883; and to the following year belong *Irex*, designed by Mr. Richardson, and *Genesta*, an America Cup competitor designed by Beaver Webb. The *Galatea*, another cup challenger, was a complete failure in home waters in 1885; but the challenger of 1887, *Thistle*, from Watson's design, met with great success before crossing the Atlantic. *Thistle* was the first large yacht constructed under the length-and-sail-area rule. *Yarana*, another Watson boat, was the chief novelty of 1888, and in 1889 the same designer produced *Valkyrie I* for Lord Dunraven. The old *Irex* continued racing with considerable success down to 1889 and was succeeded in 1890 by *Iverna*, by the same designer. In the latter year *Thistle* reappeared and thus the leading yachts of that season were the *Yarana Valkyrie I, Thistle* and *Iverna*. These were rated at 60, 77, 121 and 118 respectively. The *Valkyrie I* was ultimately sold to an Austrian archduke and the *Thistle* to the German emperor, who renamed it *Meteor*. The years 1891 and 1892 were chiefly remarkable for smaller vessels, such as Watson's *Queen Mab* and *Varuna* and Fife's *Thalia* and *Lais;* but 1893 was rendered memorable in the annals of yachting by fine contests between *Valkyrie II*, designed by Mr. Watson for Lord Dunraven; *Britannia*, designed by Watson for the Prince of Wales; *Satanita, Calluna* and *Navahoe*, an American yacht, designed by Mr. Herreshoff *Valkyrie II* proved to be the best of these cutters, but *Britannia* was a good second. In 1894 these yachts competed with *Vigilant*, a Herreshoff vessel which had defeated *Valkyrie II* in the contest for the America Cup. *Valkyrie II* was sunk by *Satanita* in the Clyde while manœuvring for a start, but *Britannia* repeatedly beat the *Vigilant*. The *Ailsa*, from the lines by Mr. Fife, Jr., and the *Valkyrie III*, designed by Mr. Watson for Lord Dunraven, appeared in 1895. The third *Valkyrie* went to America to contest the cup and the honors at home fell to *Britannia* and *Ailsa*, especially the former. Mr. Fife, however, scored in the 40-raters with *Isolde*, which was distinctly better than Mr. Watson's *Caress*. A new *Meteor*, designed by Mr. Watson for the German emperor, competed in 1896 against *Britannia* and *Ailsa*, the result for the season being: *Ailsa* (60 starts, 21 firsts), *Britannia* (58 starts, 14 firsts), *Meteor* (22 starts, 13 firsts). The principal first-class cutters since that date are *Bona*, by Watson (1897), for the Duke d'Abruzzi; *Shamrock I*, built for Sir Thomas Lipton to contest the America Cup in 1899; and *Shamrock II*, built for Sir Thomas Lipton to contest the America Cup in 1901.

American and International Yachting.—The *Jefferson*, built in 1801, is regarded as the first yacht built in America; but the first American yachts of importance were those designed by George Steers, notably the *America*. In 1857 the *America* beat all the English yachts in their own waters and established an American interest in yachting that has proved permanent. The *America* was a schooner of 208 tons and entered along with 14 other vessels for a race round the Isle of Wight. Five of the vessels were schooners, nine were cutters, the remaining one being a bark (*Brilliant*), and though they varied in tonnage from 47 (*Aurora*) to 393 (*Brilliant*) no time allowance was given. The *America* won the race and the cup presented by the Royal Yacht Squadron, the *Aurora* coming second, 18 minutes behind. In 1857 the cup was set aside by the owners of the *America* as a perpetual international challenge trophy. This was the origin of the contests for the so-called America Cup. In 1866 three American yachts, *Henrietta, Fleetwing* and *Vesta*, raced across the Atlantic, the first-named winning the race with a time of 13 days, 21 hours, 55 minutes. In 1870 the English yacht *Cambria* which had challenged for the America Cup, beat the American *Dauntless* in a transatlantic race, but she was beaten by the *Magic* and several

other boats in a race for the cup. In 1873 Mr. Ashbury, who owned the *Cambria*, again challenged for the cup, but his yacht *Livonia* was defeated by the New York Club's vessels *Columbia* and *Sappho*. Major Charles Gifford, a Canadian, challenged for the America Cup in 1876 with the *Countess of Dufferin*, but his yacht was beaten by the defender, *Madeline*. Another Canadian vessel, the *Atlanta*, contested the cup in 1881, her opponent being the *Mischief*, but the result was the same as before. Sir Richard Sutton sent the next challenge in 1885 and his yacht *Genesta* was pitted against the *Puritan*, but without success. The *Puritan* was designed by Edward Burgess, as was also the *Mayflower*, which successfully defended the cup against the English *Galatea* in 1886. The *Thistle* met another Burgess boat, the *Volunteer*, in the same contest the following year, but like all preceding challengers, she failed to gain the cup. Mr. Herreshoff scored his first great success as a designer with *Gloriana* in 1891, and soon afterward he produced the *Vigilant*, which defeated *Valkyrie II* in the America Cup contest of 1893. The cup contest of 1895 between Lord Dunraven's *Valkyrie III* and the American *Defender* had an unsatisfactory result. Two races were awarded to the latter on purely technical grounds, and in consequence Lord Dunraven withdrew from the competition. In the same year a Canadian yacht named *Canada* defeated the United States yacht *Vancedor* in a competition for an international cup. The next challenges for the America Cup came from Sir Thomas Lipton, whose yachts *Shamrock I* and *Shamrock II* were beaten by the American *Columbia* in 1899 and 1901 respectively. Sir Thomas again challenged for the cup in 1902 and 1903, and lost to the Americans.

In 1914 Sir Thomas Lipton having challenged again for the America Cup, his yacht *Shamrock IV* crossed the Atlantic, but because of the war the races were indefinitely postponed, and at last accounts his splendid craft was lying in dry dock in Erie Basin, Brooklyn. The American yachts, *Resolute* and *Vanitie*, one of which would have defended the cup, sailed 15 trial races in 1914. While the *Vanitie* won a few times, the *Resolute* was declared the better boat. The smaller sailing yachts in the United States kept up some racing, mostly under the management of those under and over draft age, but the most of the racing was suspended until after the war. Lloyds Register of American Yachts includes also those of Canada and the West Indies. There are 383 yacht clubs proper and many motor-boat clubs, some of which are miscalled yacht clubs. In 1917, 3,590 yachts in all were registered, and considering U-boat sinkings of British yachts, it is probable that the American total is now the greatest in the world. In 1917 probably half of the largest and best pleasure yachts were loaned to the United States government and some were sold outright. Many of the more commodious yacht clubhouses were also turned over to the United States navy for recruiting purposes and patrol squadrons.

Racing Rules.— The ordinary rules of the road at sea apply in the main to yacht-racing. Yachts sailing with the wind free must clear those sailing close-hauled. Yachts on the port tack must give way to those on the starboard tack, and an overtaking yacht must clear the overtaken vessel. The start in a yacht race is now always a flying one, but prior to about 1860 yachts started from anchor. Frequently much depends upon the start, and accordingly manœuvring for initial position is of considerable importance. At the start, as throughout the race, the skipper counts for a good deal. The course to be traversed is marked out by buoys, light-ships or flag-boats. The time allowances corresponding to differences in rating are determined in accordance with a scale prepared by the Yacht Racing Association. Vessels always start together, the time allowance being made at the end of the race. Handicapping is also practised to some extent in yacht-racing. Pleasure yachts are supposed to carry ensigns when in commission, also a burgee (swallow-tailed pennant) and a private signal flag. Sailing yachts fly the ensign at the main peak; power yachts hang it on a staff at the stern. All yachts when at anchor in the daytime are expected to fly an ensign from a staff at the stern. Yachts in commission usually hoist their colors at 8 A.M. and lower them at sunset. Amateur yachtsmen sailing on the coasts and Great Lakes may obtain from the Bureau of Lighthouses at Washington a "List of Lights and Fog Signals" and a "List of Buoys, Beacons and Day Marks," together with maps, which are very important in navigating.

Racing Yachts.— The designing and construction of a racing yacht require no small amount of scientific and technical knowledge besides large experience, and consequently the yachts entered for the leading races, at least in the higher classes, are the work of a very few designers and builders. In a yacht intended for racing, speed is the primary essential, and to it accommodation and convenience are in large measure sacrificed. Moreover, a designer has to take into account the circumstances under which his vessel is to be run or the competitors which she has to meet, because a yacht that does well in fine weather and a smooth sea will usually be of little account in boisterous weather and a rough sea. The rating rules of the Yacht Racing Association (formed in 1875) also condition the designer's work, and it will be necessary, therefore, to give some account of them here. The object of rating regulations is to secure that all competitors shall start on practically even terms in any given race, and this is achieved by the classification of yachts in well-defined groups according to certain measurements, and also, especially among large yachts, by means of time allowances corresponding to differences in these measurements. In the early days of racing, yachts were grouped according to tonnage, the tonnage being determined, as for other vessels at that time, by multiplying the length by the breadth and the depth and dividing by 96 (afterward 94). This was replaced by what is called builder's measurement or old measurement, which is still in use for some purposes connected with yachts. The formula for tonnage according to this system is $\frac{(L - \frac{3}{4}B) \times B \times \frac{1}{2}B}{94}$ where L. and B denote length and breadth respectively. The Thames measurement rule,

introduced in 1854, made tonnage equal to $\frac{(L-B)\times B\times \frac{1}{2}B}{94}$; but in 1881 the Yacht Racing Association introduced the 1730 rule, according to which the tonnage was equal to $\frac{(L\times B)^2\times B}{1730}$. These rules were found to have the effect of encouraging the construction of yachts of very narrow beam, especially after about 1871, when designers learned the use of outside ballast on the keel. A great change was effected in 1886, when the length-and-sail-area rule came into force, and yachts were classified according to rating determined by the formula $\frac{\text{Length}\times\text{Sail Area in sq. ft.}}{6000}$. The present linear rating rule was adopted in 1896, but it cannot be said that finality has yet been reached. Linear rating is expressed in feet and is determined by the formula

$$\frac{\text{Length}\times .75\,\text{Girth}\times .5\sqrt{\text{Sail Area}}}{2}.$$

In 1903 the rule was altered to Rating $= 18\frac{L\times\sqrt{S}}{\sqrt[4]{D}}$ where L = load water line; S = sail area; D = displacement in cubic feet. Limitations are added to prevent excessive listed length.

For the smaller vessels wood is the cheapest and lightest material, but larger ones are made of steel or of steel frames with a wooden skin, the latter class being called composite. Other metals, notably aluminum, have also been used for the construction of yachts. Practically all large composite vessels and also many small ones have a copper sheathing to protect the submerged parts of the wood from the action of the water. The sails of racing yachts are generally made of cotton, mostly of the finest Egptian variety; but ramie fibre is coming into use for this purpose, and a mixed cotton and ramie material is also in use. Up till a comparatively recent date flax was generally used for the sails of racing yachts, though it does not produce a sufficiently smooth and close-textured cloth.

Speed.— The speed of a racing yacht of given size may be regarded as the result of a compromise between stability, which determines sail-carrying power, and resistance. The stability depends upon well-known hydrodynamic principles, and may be roughly said to be determined by breadth of beam, the lowness of the centre of gravity of the vessel and the quantity and position of the ballast. Resistance at low speeds is due chiefly to surface or skin friction, but at higher speeds it is principally caused by wave-making, a phenomenon too intricate to be discussed here. An increase in beam increases stability, but at the same time increases skin friction. Wave resistance is less in vessels whose displacement is obtained mainly by breadth than in those where displacement is principally determined by depth. Various means of lowering the centre of gravity have been adopted with advantage, such as the use of hollow masts and booms, the use of aluminum for the upper part of the vessel's sides, etc. Stone ballast was used in the early days of yachting, but it was superseded by iron, and that in turn by lead. The lead ballast was afterward carried on the keel, and later the keel consisted of a plate of lead, hung horizontally below the hull. The fin-keel followed, this being a fin or extension of thin metal for carrying a lead keel to a lower position. The *America* was a keel boat, and beat out the English boats because it had a deeper draft, and because the weight of the keel was so centred as to bring the effort of the sails well aft. When other designers had profited by this idea, and further improvements were demanded, the centre-board was introduced. Many claim this to be an English invention, although it was developed to success by American designers. The centre-board is nothing more than an adjustable keel that may be raised or lowered as conditions make it best. When set low the boat can be steered much closer to the wind. The centre-board boat is very fast in smooth water and down wind. It was used on the *Magic* in 1870, the *Columbia* 1871 and on down to the *Vigilant* in 1893. American yacht builders then returned to keel designs, depending on other proportions. The *Defender*, *Columbia* and *Reliance* were all keel boats. Probably the *Madge*, of Scotch design, built in 1881, influenced designs more than any other except the centre-board. Her ballast was in one piece of lead, she was full amidships, with heavy displacement but a very light hull; though cramped in beam she was practically non-capsizable. In 1885 Sir Richard Sutton, observing the success of the *Madge*, built the *Genesta* on these lines and challenged. Burgess designed the *Puritan* on a somewhat similar model, but wider and shallower than *Genesta*, and won. In 1891 the agreed waterline length for cup-racers was 46 feet, and Herreshoff designed the *Gloriana* on new principles, giving her an overhang of some 25 feet, so that she was 71.9 over all. When the *Gloriana* heeled over she gained in waterline, and the more she leaned the more she gained. As a result, in a stiff breeze she had all the best of it and won easily. This boat was also Herreshoff's first cup-racer with a fin keel. This design was later penalized and nothing radically new in type has developed since.

Steam and Gasoline Yachts.— Pleasure yachts adopted steam power in the early days, and after the motor-boat appeared the gasoline or gas-engine was naturally adapted to nautical purposes and has become highly developed for use on the water. The typical steam yacht is the light, swift, graceful craft, more often under than over 100 feet, and frequently with most luxurious appointment. Coast yachting and world-cruising became fashionable with millionaires on both sides of the Atlantic, and very many of them have maintained floating palaces, on which they could come and go among the coast cities without dependence on public vessels or trains, and free of all hotel annoyances, for they carried kitchens and cuisines of their own. Bathrooms, electric lights, push buttons and all sorts of comforts were provided, and to be wealthy enough to own a half-million dollar yacht was the ambition of many aiming to

climb into the most exclusive wealthy circles. Gasolene was first adapted to yacht engines in 1885. It is singular to record that naphtha was then a by-product, often thrown away, as there was little use for it. The standard gas engine was studied by Carl F. Riotto and others, and developed so as to be suitable for use on yachts. It was essential to get much higher horse power than had been obtained at that time for marine work. Riotto's motor came to be known as the Standard, and in 1903 he produced a six-cylinder of 110 horse power. This was so successful that it was followed with a 300 horse-power engine next year. Craig, Seabury and other builders took up the construction of large gasoline engines, following the principles of the high-powered automobiles, and soon they were common. The Diesel engine also became available for yacht power early in the present century. Yachts built for ocean trips are called cruisers, and if swift, express cruisers. The most expensive and luxurious are usually express cruisers, though some owners have preferred less speed in order to have large accommodation for parties. A fair idea of the proportions of such boats can be gathered from the dimensions of the following: N. G. Herreshoff's *Helianthus* is 65 feet over all, 61.6 on the waterline, with 17.1 feet beam and four feet draft. She carries two Standard eight-cylinder engines. Murry Guggenheim's *Leonie* is 106 feet over all, six inches less in water-line, 20.9 feet beam and four feet draft. Her gas engines are six-cylinder. (See NAVIGATION; SHIPBUILDING). Consult 'Coast Pilot,' published by the United States Coast and Geodetic Survey; Lloyd's Register, both British and American.

YADKIN RIVER, North Carolina. See GREAT PEDEE.

YADRINTSEF, Nikolai Michailovitch, Russian author: b. Siberia, 1842; d. Barnaul, Altai Mountains, 29 June 1894. Accused in youth of conspiring for the independence of Siberia, he was exiled to Archangel, but later was permitted to return and was appointed on the staff of Governor-General Kaznakof. Between 1865 and 1875 he traveled extensively in Siberia, publishing the results of his explorations and in 1882 founded at Petrograd (later removing to Irkutsk), the *Eastern Review*, a strong popular weekly devoted to the interests of Asiatic Russia. In 1891–92 he made careful explorations in Mongolia, discovering the ruins of the ancient capital of the Tartar Khans and forming archæological collections of great value. In 1893 he visited the United States. He was the founder of the Siberian University and a promoter of universal education. Among his works are 'The Russian Commune in Prison and in Exile'; 'Siberia as a Colony' (1882); 'The Culture and Industrial State of Siberia,' etc.

YAGUARONDI, yä-gwä-rün'dę. See JAGUARONDI.

YAHOO, yä-hoo', a name given by Swift in his 'Gulliver's Travels' to a race of brutes, described as having human forms and degraded propensities. They were subject to the Houyhnhnms, or horses endowed with human reason. Hence, the term is applied to a rough, low, boorish, or uneducated person.

YAJUR VEDA, yä'joor vā'dą. See VEDIC LITERATURE.

YAK, the native name for the wild ox (*Bos grunniens*) of the mountainous regions of Tibet. There are two races: the wild yak, generally black, which is found near the snow line, descending into the valleys in winter, and a domesticated race, usually half-breeds, of various colors, black and white being most common. The yak is about the size of the common ox, to which it has a general resemblance, but it is covered with a thick coat of long, silky hair, hanging down like the fleece of a sheep, completely investing the tail, and forming a lengthy fringe along the shoulders, flanks and thighs. This fringe, which exists in both races, was apparently developed as a protection to the animal in its alpine haunts, as the long hair forms a sort of mat which defends the body from the effects of the cold when the animal is reposing in the snow.

The domesticated race is of great importance to the natives of Tibet. The yak is employed as a beast of burden, but never for tillage or draught; the milk is very rich and yields excellent butter; the flesh is of the finest quality, and that of the calves far superior to ordinary veal. The hair is spun into ropes and made into coverings for tents, and the soft fur of the hump and withers is woven into a fine strong cloth. The tails, often dyed red, are made into the chowries or fly-flappers, used in India. Yaks are often seen in zoological gardens and menageries and have repeatedly bred in Europe. It is probable that they might be advantageously introduced into the northern parts of the continents of America and Europe. They have, however, the disadvantages of not eating corn and not being able to live at a low elevation.

YAKIMA, yăk'i-mă. See SHAHAPTIAN INDIANS.

YAKIMA, a river of the State of Washington, rising in the Cascade Mountains and after a southeastward course of about 175 miles, flowing into the Columbia about six miles north of Pasco and Kennewick, and 10 miles above the confluence of the Snake River. It flows through an important coal-mining region and its valley and those of its numerous short tributaries are among the most fertile in the State. The Northern Pacific Railway traverses the whole length of the valley of the Yakima, almost to its source.

YAKIMA, or STAMPEDE PASS, a defile over the Cascade Mountains, in the State of Washington, near the source of the Yakima River (q.v.). Its highest point is 3,600 feet. It is crossed by the Northern Pacific Railway, which at an elevation of 2,800 feet, between Martin and Stampede, passes through the Stampede Tunnel, 9,850 feet long.

YAKOBA, yä-kō'bä, or **YAKUBU** (native *Bauchi*), West Africa, a town in northern Nigeria, finely situated on a plateau partly surrounded by mountains, 140 miles southeast of Kano, and on a caravan route. It is walled and the interior is finely diversified with gardens and ponds. The climate is healthful. Pop. 70,000.

YAKONAN (from *yakwina*, "spirit"). A linguistic stock of North American Indians, consisting of the Alsea, Yakwina, Kuich and Siuslaw divisions. They were physically of the type of the Northwest Coast Indians and were the southernmost tribe practising artificial deformation of the head. Their mythology and traditions were chiefly of the North but were somewhat modified by contact with the Indians of the California coast. Slavery existed among them until they came under the control of the United States. The home of the Yakwina was along Yaquina River, Oregon, from the site of Elk City to the sea; they were formerly numerous, occupying 56 villages in early days, but the tribal distinction of the Yakwina, as well as of the other Yakonan divisions, was gradually broken down through their preference for marriage outside the tribe; there are only a few Yakwina left and these reside on Siletz reservation, but their number is unknown. The Alsea formerly dwelt in villages along both sides of Alsea River, Oregon, and on the adjacent coast; they are now on Siletz reservation, and perhaps a few are on Grande Ronda reservation. The Siuslaw were also village dwellers, inhabiting Siuslaw River as late as 1857; they are probably extinct. The Kuich or Lower Umpqua, villages were on both sides of Umpqua River from its mouth upward for 30 miles; a few survivors still reside on Siletz reservation. The entire population of the Yakonan Indians probably does not exceed 400.

YAKUB BEG, yā-koob' bēg, surnamed ATTALIK GHAZI ("leader of the champions of the faith"), amir of Kashgar: b. Russian Turkestan early in the 19th century; d. 31 May 1877; He distinguished himself in the defense of Khokan against the Russians. But he first rose to great eminence after the recovery of Kashgar from the Chinese in 1864, when he acted as lieutenant to Buzurg Khan, whom he soon supplanted. For 12 years this remarkable man conferred on a large part of Central Asia the benefits of a settled though rigorous government. He drilled and disciplined a large civil staff, while his army contained the best native soldiers in Central Asia. In his foreign policy he was strongly anti-Russian, and ultimately friendly to Great Britain. China, however, set out to recover its lost Mohammedan provinces and had gained some victories when Yakub died — by assassination, some said. His realm at once fell in pieces. The Chinese armies overran the country (1878), and Kashgar again came under Chinese rule.

YAKUB KHAN, khān, ex-amir of Afghanistan: b. 1849. He was a son of the amir Shere Sli; was appointed governor of Herat by his father and became extremely popular, but in 1870 broke into open revolt, and in 1874 was imprisoned at Kabul. On the death of Shere Ali he was proclaimed amir (1879) and concluded a treaty of peace with the British at Gandamak. By the terms of this treaty he was to receive a British resident, and on his side to obtain from the British government a subsidy and aid in case of foreign attack. The murder of Sir Louis Cavagnari, the resident, with staff and suite, occurred in the following September. Yakub was suspected of complicity. Lord Roberts (then Sir Frederick) defeated the Afghan force 6 October and seized Kabul on the 12th. Yakub abdicated and fled to the British camp. In December he was sent to India as a deposed ruler.

YAKUTSK, yā kootsk', Asiatic Russia. (1) A town of Eastern Siberia, capital of the government of the same name, on a plain surrounded by lofty heights, on the left bank of the Lena. The streets present a singular aspect, being composed of about 400 houses of European structure, standing apart, while the intervening spaces are occupied by winter *yurts* or huts of the northern nomads, with walls of cow-dung, earthen roofs, and doors covered with hairy hides. The principal buildings of the town are a large stone cathedral, other churches, a synagogue, a market-house and several educational institutions. Inundations are frequent and the town is consequently unhealthful. The trade is important, Yakutsk being the chief commercial emporium for the whole of Eastern Siberia. The principal articles of native produce are furs and fossil ivory, which are exchanged for European produce. Important fairs are held. Pop. about 8,209. (2) The government of Yakutsk has an area of 1,533,397 ('Century Dict.' and 'Encyc. Brit' give 1,530,253; other authorities, 'Standard Dict,' Lippincott, Longman, agree with 'International') square miles, or about two-fifths of that of Europe. The surface is generally low in the north, but rises toward the interior, and in the south and east is covered by the Yablonoi or Stanovoi Mountains and their offshoots. A noteworthy feature of the country is the *tundras*, immense boggy plains, which stretch along the north. Farther south there are good pastures, and wheat and rye are successfully cultivated, even where the ground is frozen to a depth of 600 feet, the summer heat being strong enough to thaw it sufficiently deep for cultivation. There are a number of large rivers teeming with fish, the principal being the Lena. There are valueable forests in the south, frequented by numerous fur-bearing and other animals. Gold and salt are mined but other mineral wealth, including coal, is practically untouched. Caravans with Chinese and European goods collect the produce of the whole line of coast on the Polar Sea between the parallels of 70° and 74°, from the mouth of the river Lena to the farthest point inhabited by the Tchukchis. The towns are chiefly inhabited by Turks and Cossacks, but the great body of the people are nomads, consisting of Yakuts, Tunguses, etc. Frosts of 79.5° F. are recorded and the period free from frost is only about 37 days. The climate is the coldest in Siberia. Pop. about 325,000.

YALE, Elihu, English philanthropist: b. in or near Boston, Mass., 5 April 1648; d. London, England, 8 July 1721. His father was Thomas Yale, one of the original settlers in New Haven, Conn., in 1638, but who removed to Boston soon afterward and to England in 1651, followed by his family the next year. The son was educated in England, engaged in trade in India in 1672, and in 1687-92 was governor of the East India Company's fort at Madras. He returned to England in 1692 and, although he never revisited New England, he displayed his interests in the Collegiate School founded at Saybrook in 1700 by sending gifts of money and books to the amount of some £600 in 1715, 1718

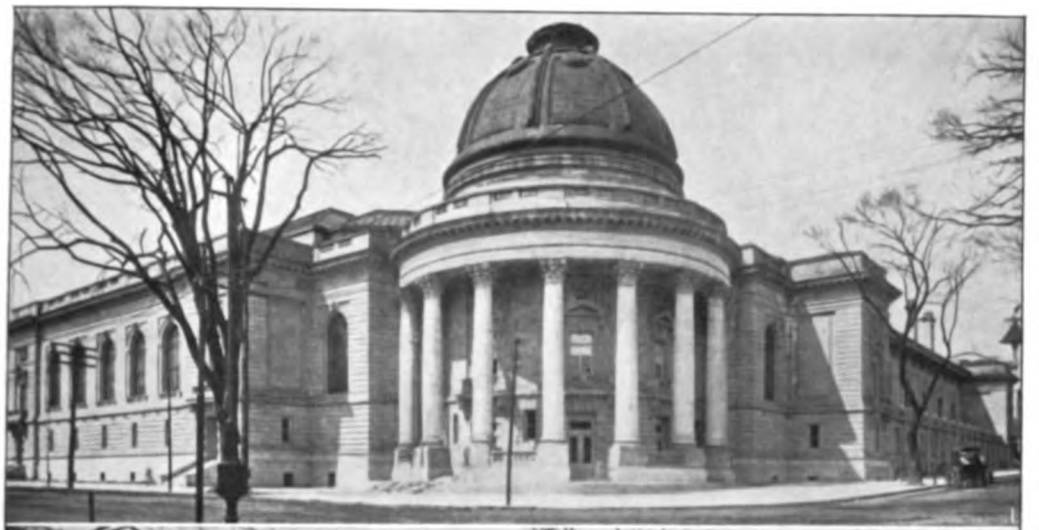
geology, in biology preparatory to medicine, in studies preparatory to a forestry course, and in select studies preparatory to other higher studies. One of the most elaborate additions to the courses in recent years is provided for by the Hammond Mining and Metallurgical Laboratory, the gift of John Hays Hammond of the Sheffield class of 1875.

The School of Fine Arts offers both technical courses and courses in art, history and criticism; the regular course is three years in length for the completion of which a diploma is conferred. The degree of Bachelor of Fine Arts is conferred on the completion of certain advanced studies and the presentation of a thesis. The School of Music offers both theoretical and practical courses. The degree of Bachelor of Music is conferred for the completion of advanced courses. The Yale Forestry School was established in 1900; it offers a two years' course, the work of the second year being largely field work. The degree of Master of Forestry is conferred on those who have received a bachelor's degree or have had the equivalent of college training. A Summer School of Forestry is also maintained at Milford, Pa. The Graduate School was organized as a separate school in 1847, the professors of the other sections of the Department of Philosophy and the Arts constitute the faculty of the Graduate School. Graduate courses are offered in the Academic Department, the Scientific Department, the School of Fine Arts and the Department of Music. The degrees conferred are A.M., M.S., Ph.D., C.E. and M.E. In addition to regular class and laboratory work of the school there are numerous voluntary associations of professors and students for the advancement of graduate work in the several departments of study. The Divinity School offers a regular course of three years leading to the degree of B.D. Seniors in the college may elect such courses in the Divinity School as to shorten the course to two years. A fourth year of graduate work is also provided. The work includes both prescribed and elective courses; elective courses in sociology, and in the study of missions are included in the curriculum. The Medical School offers a four years' course leading to the degree of M.D. Ample provision for clinical work is made in the New Haven Hospital, the State Hospital for the Insane at Middletown and the Springside Hospital. The Law School course covers three years. Previous to 1896 it was two years in length. The degrees of Bachelor of Laws and Bachelor of Civil Law are conferred, the same amount of work being required in each course. Students in the college may so arrange their course as to receive the degrees of arts and laws in six years. Graduate courses are provided, leading to the degree of Master of Laws and Doctor of Civil Law. The school was the first in America or England to establish a course leading to the latter degree.

Women are admitted to the School of Fine Arts, the Department of Music, and the Ph.D. courses of the Graduate School, and public school teachers are admitted to some of the regular courses. Numerous scholarships and fellowships are provided in the Academic Department, the Scientific School, the Divinity School and the Graduate School. A "Bureau of Self Help" is maintained, through which students are aided in obtaining employment. The university maintains a public lecture course, and provides several series of lectures in the different departments; prominent among the latter are the Lyman Beecher lectures on preaching, the Dodge lectures on the responsibility of citizenship, the Bromley lectures on journalism, literature and public affairs and the Silliman Memorial lectures, of which 12 volumes have been published by the Yale University Press. In 1918 Silliman lectures commemorated the 100th anniversary of the founding of the *American Journal of Science* by Professor Benjamin Silliman in July 1818. They were published as a full volume-number of the Journal entitled 'A Century of Science in America,' with special reference to the *American Journal of Science*. The Journal has for the full century of its existence been edited by three Yale men, Silliman and the elder and younger Dana. It is, however, not directly a Yale institution, though in a sense a Yale reflex of the development of scientific research in America. Its scope and influence it has continued national throughout the century of its existence. The University Library in 1919 contained over 1,000,000 volumes, exclusive of pamphlets. It is supplemented by a series of special libraries. There are the Linonian and Brothers Library, the Dwight Hall Library, the Law Library, the Scientific School Library, the Trowbridge Reference Library of the Divinity School, the Lowell Mason Library of Church Music, the Library of Foreign Missions and several other department and club libraries. The Peabody Museum was established in 1866 by a gift of George Peabody (q.v.) and in it were accumulated excellent collections in mineralogy, geology and paleontology and zoology. As part of the building plans now under way, however, the old building has been removed, and these collections, in large part unique, are at present inaccessible to the public, awaiting the erection of a new museum, or new geologic and paleontologic laboratories to take its place.

During the war Yale closed the regular courses, turning her dormitories into quarters and developing a Reserve Officers Training Corps and a Naval Training Unit. Her war activities constitute an important chapter in the history of American participation in the great conflict. With the resumption of normal interests following the war, a far-reaching reorganization has been effected, involving the status of governing boards and more or less all departments and all students. New university officers have been created. There is now in addition to the president, a provost. The undergraduate schools are more closely co-ordinated, entrance requirements changed, and a common undergraduate Freshman year adopted. The important decision has also been reached that the degree of Bachelor of Philosophy shall be awarded to students who enter Yale without Latin, the B.A. degree being reserved for those offering Latin at entrance. All Sheffield undergraduates become candidates for the degree of B.S. Inasmuch as these changes are so recent and have not yet had catalogue announcement, they are not further outlined here. They are in a full measure epochal, coming as they do at the time of the great Stirling bequest of some

YALE UNIVERSITY



1 Woolsey Hall
2 Osborn Memorial Laboratories
3 Southeast Corner of the New Haven Green, showing, from left to right, Osborn, Welch, Phelps, Lawrence, and Farnam Halls, with Battell Chapel and the First Methodist Church at extreme right

$15,000,000, as well as in a period as distinctly formative as that following the Civil War and the passing of the old Campus group of buildings. The buildings of the university known as the Bicentennial buildings include Woodbridge, Woolsey, Memorial and University halls. They were erected by the graduates in 1900, 1901 and 1902 in commemoration of the 200th anniversary of the founding of Yale College. The buildings were designed by Carrere and Hastings of New York and cost about $1,000,000. They are of Indiana limestone with granite foundations. Memorial Hall, in the centre of the group, is becoming the regular place for tablets and other memorials to graduates of the university. The following collections are on exhibition in Memorial Hall; Autograph Letters and Engravings of Eminent Yale Men; the Morris Steinert Collection of Musical Instruments, and the Rebecca Darlington Stoddard Collection of Greek and Etruscan Vases.

The Yale Roll of Honor, containing the names of 192 Yale men who gave their lives in the Great War, is also in this hall.

Woolsey Hall (see illustration of interior, Plate II, photograph 2) is a part of the group of Bicentennial buildings erected by the graduates at a cost of over $1,000,000 in commemoration of the 200th anniversary of the founding of Yale. The hall holds 2,700 people and is acknowledged to be one of the best auditoriums in America. The organ, which is unsurpassed in America and is the third largest in the world, was designed by the Hutchins-Voltey Company of Boston, and is the gift of the Newberry family of Detroit. In 1916, through additional gifts of the Newberry family, the organ was entirely rebuilt by the J. W. Steere and Son Organ Company of Springfield, Mass. The organ now contains 22 stops in the great organ, 22 stops in the swell organ, 11 stops in the choir organ, 16 stops in the solo organ, 13 stops in the orchestral organ and 11 stops in the echo organ. There are, in total, 163 draw-stops, 32 couplers and 78 other piston and pedal accessories. There are more than 7,000 pipes.

The Osborn Memorial Laboratories (see illustration, Plate I, photograph 2), accommodating the departments of Zoology, Comparative Anatomy and Botany, were erected by means of funds paid over to the university by the executors of the late Mrs. Miriam A. Osborn, being the portion of her residuary estate which was bequeathed to the university. The cost of these laboratories amounted to about $500,000. During her lifetime Mrs. Osborn erected Osborn Hall in memory of her husband. The Mason Laboratory of Mechanical Engineering (see illustration) was built in 1910 by William Smith Mason and George Grant Mason, both of the Class of 1888, Sheffield. Constructed of brick, with a limestone façade on Hillhouse avenue, it extends through to Temple street in the rear. There is here installed one of the most complete machine testing plants in the country, with large units affording unusual opportunities for experimental work and practical instruction.

A panorama of Yale is scarcely satisfactory. But the buildings facing the "Green" (see Plate I, photograph 3) are in the near sense Yale's "front row." Through the Phelps Gateway (at the centre) is entered the old campus, with its "old fence," the Nathan Hale statue and the "Old South Middle" now nearly all that remains of the old Yale. On the southwest corner of the campus are Vanderbilt Hall, the School of Fine Arts (where is housed the famous Jarvas collection of 13th to 17th century Italian paintings, "primitives") and the libraries. On the northwest are Dwight, Wright and Durfee Halls. Back of the campus group of dormitories on the site of the old Peabody Museum and taking up the entire block between High and York streets, there is now in course of erection a magnificent Memorial Quadrangle, the gift of Mrs. Stephen V. Harkness. Across the way (Elm street) is the gymnasium. The main extension of Yale is, however, to the right and northerly from Battell Chapel. There follow, in the order named: (1) The Berkeley Court—Blount avenue series of buildings; (2) the Bicentennial group of buildings (Plates I and II); (3) the Sheffield Scientific School (on Prospect street and Hillhouse avenue); (4) the Sachem's Wood or Pierson-Sage square group, including the Osborn Laboratories (Plate III), and the Sloan Physical Laboratory (with probably the site of new geologic-paleontologic laboratories); (5) continuing on Prospect street, the Forestry School and Botanic Garden, and (6) the Astronomical Observatory. The latter are about one mile northerly from the Phelps Gateway. The Medical Hall and the Medical School Laboratory lie to the west of the campus; the University Clinic Building is opposite the New Haven Hospital; the Forestry School occupies Marsh Hall, the house of the late Professor Marsh in the Botanical Gardens. The old athletic field of 30 acres is situated about a mile and a half west of the campus, and adjoining is the new field of 100 acres, including the Yale Bowl which covers 25 acres, and seats over 60,000 spectators. In this great amphitheatre are held the football games and various open air spectacles and pageants more or less closely associated with university life and interests. The gun club range and Armory are near by. The Adee Boat House is on the harbor, and at Gale's Ferry on the Thames River are quarters for university and freshman squads and equipment for crew training for the final races. The students maintain a Christian Association, an Athletic Association; numerous literary, dramatic and technical societies, and social and special literary and technical clubs. In addition to the university dormitories, a number of student fraternities have fine homes for their membership. There are also the chapter houses or "tombs" of these fraternities, of more or less individualistic architecture, and one of the odd attractions of the university zone westerly and northerly from the "Green." Among these are the three senior society tombs, "Skull and Bones," "Scroll and Key" and the "Wolf's Head," with the Sheffield "Book and Snake" and Phi Gamma Delta. They are full of local interest and color, and unfailingly arrest the visitor's attention. A chapter of Phi Beta Kappa is also located at Yale. At the time of entry into the World War in 1917, professors and other

officers numbered 609, and the total number of students was 3,306.

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YA-LU-KIANG. See YALU.

YALU, yä'loo, Chosen, a river forming the boundary with Manchuria. In its upper reaches it is known as the Am-nok or Ap-nok. Its source is in the Paik-tu-san, the highest peak (8,000 feet) of the Shan-a-lin Mountains of Manchuria. It flows into Korea Bay, near Wi-ju, after a southwesterly course of about 300 miles, and has numerous tributaries, chief of which is the Chang-jin River. It is navigable for sea-going vessels 30 miles from its mouth and by smaller vessels 145 miles to Wiwen. On 17 Sept. 1894 its mouth was the scene of the battle in which a Chinese fleet of 12 warships, some of them powerful ironclads, and 16 other vessels, was defeated, with the loss of four vessels, by a Japanese force of 11 war vessels and two others. During the Russo-Japanese War of 1904 its banks witnessed much skirmishing and fighting. The Japanese have renamed it Oryoku. See MANCHURIA.

YAM, a popular name for various species of the genus *Dioscorea* of the family *Dioscoreaceæ*, and loosely applied to certain varities of the sweet potato. The true yams belong to a genus consisting of more than 150 species widely distributed throughout the tropics. They have herbaceous, twining or creeping stems; broad, alternate or opposite, usually simple leaves; and small dicœcious flowers, followed by three-winged capsular fruits containing winged seeds. The fleshy roots of some species are widely eaten in the tropics. One of the best-known species is *D. alata*, a native of India and the South Sea Islands, but distributed throughout the tropics. Its tubers usually attain a length of three feet and a weight of 30 pounds, but specimens three times as large are not uncommon. They are black or brownish externally and pink within, and are rich in starch. When boiled their acridity is dispelled and they become of pleasant flavor. It is claimed that this species is the parent of most of the edible so-called species such as *D. sativa*, *D. aculeata*, *D. rubella*, *D. globosa*, etc. The air-potato (*D. bulbifera*) is an Asiatic species cultivated to a small extent in the southern United States, and in conservatories, for its odd, angled tubers, which are borne in the axils of the leaves. They often exceed two pounds in weight and are sometimes eaten like potatoes. The Chinese yam, Chinese potato, or cinnamon vine (*D. divaricata*), is a native of the Philippine Islands, whence it has been introduced into the gardens of temperate as well as tropical climates for ornament. It bears cinnamon-scented white blossoms and aerial tubers which are used for propagation. As far north as New York the plants have proved hardy.

YAM-A-MAI, an Oriental kind of silkworm (*Antheræa jama-mai*), which feeds on the oak, and produces a silk, known by the same name, with peculiar, but useful qualities, extensively utilized in Japan and somewhat elsewhere. See SILKWORMS.

YAMA, yä-mä', a Hindu god, the judge of the dead, whose good and bad actions are read to him out of a record, and who according to their merits and demerits are sent to the celestial or to the infernal regions. Hindus offer to him daily oblations of water. See also LAMAISM.

YAMADA. See UJI-YAMADA.

YAMAGATA, yä-mä-gä'tä, Aritomo, PRINCE (early name KYŌSUKE) Japanese soldier and statesman: b: Chōshū (or Nagato) province, 22 April 1838. He was educated by the patriot Shōin Yoshida; was active in the overthrow of the shogunate, and was made second vice-minister of war under the new government. In 1869 he visited Russia and France for study of their military institutions. In 1876–77 he ably directed the Satsuma rebellion campaign, in 1878 was made commander of the imperial guard and chief of the general staff. He was Prime Minister in 1889–91, in which post he greatly strengthened the army and navy; and Minister of Justice in 1891–93. He was appointed to command the first army corps in the war with China in 1894, and quickly expelled the Chinese from Korea. His policy was throughout one of study of Western methods. He was a skilful strategist, and was made field-marshal in 1898, receiving also the title of marquis. He was again Prime Minister in 1898, and was chief of staff in the Russo-Japanese War. He became president of the Privy Council in 1905, and was raised to the rank of prince in 1907.

YAMAGATA, Japan, a town in the island of Hondo, capital of a prefecture of the same name, 200 miles north of Tokio. Pop. (city) 42,234; (prefecture) 938,014.

YAMAGUCHI, yä-mä-goo'chē, Japan, city, capital and chief city of the prefecture of Yamaguchi, in the southwestern part of the island of Hondo, 15 miles back from the coast, and 220 miles west of Osaka. It was formerly the residence of the lords of Choshu, a Mori family, and became the seat of the local government in 1860. In 1550 a church was established here by Francis Xavier, but was finally destroyed. Pop. (city) 21,100; (prefecture) 1,068,935.

YAMAJI, yä'mä-jē, Motoharu, VISCOUNT, Japanese soldier: b. Tosa province, island of Shikoku, about 1840; d. 1903. He won distinction in the campaign against the unsuccessful revolt in Satsuma province (island of Kiusiu) in 1877; and was promoted lieutenant-general. In the Chinese-Japanese War of 1894–95 he had the immediate direction of the attack on Port Arthur, which was finally taken on 22 Nov. 1894. This won for him a great reputation in Japan, where, in allusion to his loss of an eye, he is known as the "One-Eyed Dragon."

YAMAMA MOLTE. See SILKWORMS.

YAMANOUCHI GUN. See ORDNANCE.

YAMASKA, yä-mäs'ka, Quebec, Canada; (1) a village and railway junction of Yamaska County, on the Yamaska River, 31 miles north of Saint Hyacinthe. The river affords power for several mills. Pop. about 900. (2) A county bordering on Lake Saint Peter; area, 183,705 acres. Capital, Saint François du Lac. It is drained by the Yamaska, Nicolet and Saint Francis rivers. Pop. 16,204. (3) A river flowing from Brome Lake, Brome County, west, then north, and after a course of about 100 miles through a fertile country, draining into the Saint Lawrence River at Lake Saint Peter.

YAMBO, yäm'bō, **YAMBU,** yäm'boo, or **YEMBO-EL-BAHR,** yĕm'bō-ĕl-bär, Arabia, a seaport town on the Red Sea, in the province of Hedjas, 115 miles west of Medina, of which it is the harbor. Marking the end of the third quarter of the caravan journey from Cairo to Mecca, the town bears the title "Gate of the Holy City." The town consists of a long row of white houses built of limestone and coral-line, standing on the edge of an arid plain. It has considerable imports and transit trade between Suez, Jidda and Medina. Pop. about 6,000.

YAMEO (also **LLAMEO, LAMA, LAMISTA** or **LHAMEOS),** South American Indian tribe of northeastern Peru, living along the Marathon (Upper Amazon), the lower Huallaga and Javery rivers, and formerly between the Tigre and Napo rivers. Physically they are smaller than the other tribes of the region. They have a distinct language, and while formerly warlike are now in the main peaceable agriculturists and weavers. The portion of the tribe living farthest to the east maintains its primitive customs, but the larger part of the tribe has become merged in the general country population. Franciscan missionaries brought most of the tribe under the influence of civilization. Consult Brinton, D. G., 'The American Race' (New York 1891).

YANA ("people"), a small tribe, forming the Yanan (or Noje, or Nozi) linguistic stock of North American Indians, whose former habitat was bounded on the east by a mountain range a little west of Lassen Butte, and terminating near Pit River, in northern California; on the north by a line running northeast to southwest, passing near the northern side of Round Mountain, three miles from Pit River; on the west by a line extending from Redding southward on an average 10 miles to the eastward from Sacramento River; north of Redding it approximates twice that distance. They were massacred by the miners of the neighboring country in August 1864, all but 50 being killed. The tribe and stock were represented in 1884 by 35 individuals divided into two groups — one at Redding, the other in their original country at Round Mountain and in 1902 but six remained. They have a tradition to the effect that they came from the East and it is said that in physical traits they differ markedly from all the northern California Indians.

YANA, yä'nä, or **JANA,** Eastern Siberia, a river which rises in the Verkhoyanskii Mountains, and after a northerly course of about 750 miles enters the Arctic Ocean through Yana Bay, near Ustjansk, by seven large and many small mouths.

YANCEY, William Lowndes: American political leader and orator: b. Ogeechee Shoals, Ga., 10 Aug. 1814; d. 27 July 1863. He was the son of Benjamin Cudworth Yancey, a political leader of the South, who died at the age of 36. His stepfather was Rev. Nathan Benden of New York. Yancey studied at Williams College, but lack of funds arrested his course there before he was graduated. He entered the law office of B. F. Perry at Greenville, S. C., was admitted to the bar in 1834, and began to publish the Greenville *Mountaineer,* which was opposed to nullification, and supported the Union. In 1835 he married Miss Earle of Greenville, who was possessed of a considerable fortune in negro slaves. Yancey resolved then to abandon law and undertake cotton planting at Catawba, Ala. However, a local feud resulted in the poisoning of the Yancey wells and the consequent death of the slaves, and he was forced to abandon the plantation. He re-entered his profession, resumed his journalistic efforts, and became a commissioner in bankruptcy. At Wetumpka, near Harrowgate Spring, Yancey owned and edited a weekly newspaper, and established a flourishing law practice. He sat in the Alabama legislature, and was active in reform measures (1841–44). After a vigorous campaign he was elected to Congress for the term 1844–46. After a duel with Representative Clingman of North Carolina, Yancey resigned from service in Congress, disappointed in that body. He moved to Montgomery, Ala., where he entered the firm of Elmore and Yancey, and soon recuperated his lost fortune. He now began a career of unofficial political leadership, peculiar to himself. At the National Democratic Convention at Baltimore Yancy led the movement which resulted in the adoption of the "Alabama Platform." This instructed the delegates not to vote for any candidate opposed to government protection of slavery. In spite of this organized effort, General Cass, the nominee of the Baltimore convention, received the electoral vote of Alabama.

When the question of secession was under consideration in 1851, Yancey favored withdrawal from the Union. When the State refused to summon the legislature to submit the question of convention to the people, he summoned a non-partisan mass State convention which sent representatives independently to the Democratic convention at Cincinnati. Yancey now became the controlling force in the radical politics of the State. He also made a canvass of the North, speaking eloquently in favor of secession and slave owners' rights, after the meetings of the Charleston Democratic Convention. The election of Lincoln was partly due to the split in the Democratic party which Yancey led. After the secession he was sent by the Confederacy to secure the recognition of the various European governments. His efforts at London and Paris were unsuccessful and he returned in 1862, when he was elected senator of the legislature of Alabama. He served in the Confederate Senate until his death. Consult Du Bose, J. W., 'Life and Times of William Lowndes Yancey' (Birmingham 1892).

YANES, yän'ĕz, **Francisco Javier,** Venezuelan diplomat: b. Caracas, Venezuela, 6 May

1861. From 1892 to 1897 he was vice-consul and acting consul-general of Venezuela at New York and in 1901–03 served as Spanish secretary and chief of the translations division of the United States Philippine Commission, Manila. From 1905 to 1910 Señor Yanes was secretary of the governing board of the International Bureau of American Republics and since 1910 has been assistant director and secretary of the governing board of the Pan-American Union, Washington, D. C. At the Jamestown Exposition of 1907 he represented the International Bureau of American Republics and was a member of the jury of awards. He is a member of the American Academy of Political and Social Science, the American Society of International Law, and of many other learned bodies. Señor Yanes is a writer on literary and political subjects.

YANG-BAN (two divisions, civil and military). The name first given to the privileged classes in Korea, during the Korai dynasty (918–1392), when the inhabitants were classified as nobles, commoners and slaves. The nobles, owing allegiance to the king, exercised within their own domains both civil and military authority. In time, these functions and classes were separated, the civil officers being called East Division and the military, West Division, according to their place at court. After 1392, under the new dynasty, when Buddhism fell and Confucian ethics and Chinese ideas prevailed, many able commoners entering politics, the ruling classes numbered five, nobles, local yang-ban, middle-class men, common people and slaves. In this new classification, the noble yang-bans held the chief government offices and were immune from taxation. If not earning a living, they lived off the people. The chief families or clans were the Kim, Chwe, Pak, Li, Chong and An (the Six Families), and later the Min and Cho. The stories of their bitter feuds make up the substance of modern Korean history, culminating in the murder of Kim Ok Kun and Queen Cho. With other clans and their subdivisions, numbering over a score, there were, in 1910, 54,000 yang-ban families, comprising one-fiftieth of the households in Korea; two central provinces having a total of 35,630 families; though the yang-ban are scattered all over the peninsula. Without domains or fixed stipends, the yang-bans, despising labor and looking only to official positions and income — when there are but 17,000 offices of any and all sorts open to Koreans — the condition of 37,000 families in this proud class is that of poverty. In old days, a man in high office would have 200 or 300 hangers-on to look after, the public looking on his supporting so many relatives as a great virtue. When Korea, in 1912, for the third time in its history, was given the name of Chosen, apart from the creation of a new class of nobility pensioned by the Japanese government, all the old class distinctions and privileges — of amazing and curious variety — were abolished. Yet as social ideas, habits and customs die slowly, the yang-ban, like the old samurai of Japan, still enjoy, locally, much of the old-time prestige. The history of Korea, especially in its modern phases, cannot be understood without some understanding of the social influence of the yang-ban and their feuds. Consult Hulbert, 'The Passing of Korea' (1906); Griffis, 'Corea, the Hermit Nation' (1907), the official Annual Reports on Reforms and Progress in Korea (1917–18), and the Eastern Asia Official Guide Book: Vol. I, Manchuria and Chosen.

YANG-TSE-KIANG, yäng'tsē-kē-äng, the name generally given to one of the greatest rivers of China throughout its entire course, although this name is only applied in China to the lower course of the river, the entire river being called simply Kiang, or Ta Kiang (river or great river), while in the various provinces it traverses it is generally known by special names. It rises in the Tangla Mountains in mid-Tibet, about lat. 35° N. and long. 89° E., at an altitude of from 16,000 to 19,000 feet, and is first known by the name of Muru-Ussu. In its upper course it is sometimes called the Kincha-kiang. Its upper course through the mountainous region of Tibet extends to about 1,100 miles, during which its windings and falls present numerous striking scenes of natural beauty. It crosses the Chinese frontier in the province of Sze-chuan, then flows southward and eastward through Yunnan and northeast back through Sze-chuan Yunnan. Between the town of Li-kiang in this province and Hui-li in Sze-chuen, for a course of about 250 miles, it flows in an easterly direction through a winding channel or mountain gorge of imposing grandeur. Traversing the whole province of Sze-chuen in a northeasterly direction and passing in southeasterly direction into the province of Hu-peh, it reaches at King-chau the great Chinese plain, and traversing the provinces of Ngan-hui and Kiang-su, and passing the cities of Han-Yang, Han-kau, and Wu-chang, a great seat of the tea exporting trade, Ngan-king, Nanking, and Chin-kiang, it enters the Tung-hai, or Eastern Sea, above Shanghai. Its direct course from its source to its mouth is estimated at 1,800 miles; its course with windings is about or considerably over 3,000. It receives numerous affluents, and is crossed by the Grand Canal, which forms a junction between it and the Hoang-ho. The summer rains combined with the melting snows of the mountains in Tibet cause the river to rise at times as much as 40 or 50 feet at Hankow and Chin-kiang, resulting in great loss of life and serious damage to crops and other property. The drainage area is about 650,000 square miles, and it is estimated that the river annually carries away 6,428,000,000 cubic feet of sediment, the volume of water is 770,000 cubic feet a second. Steamers of 5,000 to 6,000 tons burthen easily reach Hankow, 680 miles from the sea, except at low water in winter. The river and the ports of Chin-kiang and Han-kau were opened to foreign navigation in 1860, I-chang (1,000 miles up), and others since. A British squadron sailed up the river in 1861 for more than 800 miles. The last 200 miles of its course is through practically level land, and in the first 1,000 miles the rise of the river is only 130 feet. It constitutes a most important waterway, carrying about one-half of the sea-borne traffic of China; and it is equally valuable commercially as a means of intercommunication throughout the country. The navigation above the confluence of the Tung-ting is interrupted by rapids. The tidal

influence reaches in February to Lake Poyang, 436 miles from the sea. Consult Gill, W. J., 'The River of Golden Sands' (1883); Little, 'Through the Yang-tse Gorges' (1898).

YANG AND YIN, in Chinese philosophy, terms employed to indicate the two phases, light and darkness, under which the supreme principle of the universe, *Tai-ki*, displays itself in the world of phenomena, Yang and Yin being, in various proportions, blended in all forms of existence.

YANKEE, a cant name for Americans belonging to the New England States. During the Revolution the name was applied by the British to all the insurgents; and during the Civil War it was the common designation of the Federal soldiers by the Confederates. In Europe the term is sometimes improperly applied generally to natives of the United States. The most common explanation of the term seems also the most plausible, namely, that it is a corrupt pronunciation of English or of French "Anglais" formerly current among the Massachusetts Indians. See NICKNAMES.

YANKEE DOODLE. The air of Yankee Doodle is said to have been a British air known in the time of Cromwell by the name of Nankee-Doodle, and played with derisive reference to the similarity of this name to Yankee by the British troops in evacuating Boston. The Americans took it up and made it a national air. See NATIONAL HYMNS.

YANKEE GANG, a term used in Canadian sawmills for a method adapted for sawing logs 21 inches in diameter and under. It consists of two sets of gang saws, connected by parallel ways. The slabbing gang reduces the log to a balk and slab boards after which the balk is transferred to the stock gang, which rips it into lumber.

YANKTON, S. Dak., city, county-seat of Yankton County, on the Missouri River and on the Chicago, Milwaukee and Saint Paul, the Great Northern, and the Chicago and Northwestern railroads, 60 miles northwest of Sioux City and 135 miles northwest of Omaha, Neb. The city is the commercial and industrial centre of a large agricultural and stock-raising region. The chief industrial establishments are Portland cement works, flour mills, brick yards, grain elevators and stock yards. The city owns and operates the waterworks. The educational institutions are Yankton College (Congregational), opened in 1882; Saint Joseph's Academy, a public high school, public and parish elementary schools. It has the South Dakota Hospital for the Insane, and a modern fireproof hospital in charge of the Sisters of Saint Benedict. Yankton's water supply is obtained partly from artesian wells. There are two national and two State banks and a loan and trust company; the five have deposits of over $3,000,000. The city has many miles of concrete paving, and has raised $1,300,000 to construct a combination railroad and wagon bridge across the Missouri River. Yankton was settled by Eastern people in 1862, and in 1883 received a city charter. Until 1883 it was the capital of the Territory of Dakota. It has the commission form of government. Pop. 5,500.

YANKTON COLLEGE, located at Yankton, S. Dak. It was established by the General Association of Congregational Churches of Dakota in 1881, opened to students in 1882, and is the oldest institution of higher learning in the Dakotas. The college is non-sectarian and is open to both men and women. The organization includes the following departments: (1) the College; (2) the Academy; (3) the Normal Department; (4) the Conservatory of Music; (5) the Department of Art; (6) the Department of Expression; (7) the Commercial Department. The college offers a four years' course leading to the degree of B.A. The work of the freshman year gives an option between Greek or Latin and Mathematics. Bible study is not required, but there are a number of electives; courses in education are included in the curriculum. The Conservatory of Music offers courses of three to eight years in pianoforte, pipe organ, voice and violin. The course in commercial studies covers two years. Gymnasium work is required of both men and women, and there is an athletic park, and ample provision for athletic sports. The students maintain Young Men's and Young Women's Christian associations, literary societies, a branch of the Inter-Collegiate Oratorical and Debating Association and athletic associations. The college has an attractive campus of 25 acres, including the Athletic Park (five acres) to the north of the main Campus and Observatory Hill to the south. The buildings are Middle College, Young Women's Dormitory, the Ward Hall of Science, the Clarke Observatory, the gymnasium, the library and a central heating plant. A Summer School was established in 1903. The students in 1919 numbered 517, of whom 174 were in the College.

YAO, or YAU, ancient Chinese emperor: reigned about 2357–2258 B.C. He was the first of the three model emperors extolled in the 'Shu-king' or 'Canons of History,' the oldest Chinese source of pre-Confucian history, supposed to have been edited by Confucius himself. In the works of Confucius Yao is celebrated as the embodiment of all the virtues requisite for his high position. His patronage of astronomical works and of engineering are highly emphasized, and his government is described as a model of good organization. The great Chinese flood occurred in his reign, and when after several years' endeavor the engineers failed to check it, Yao decided to abdicate. He chose for his successor not his son, but a young man named Shun, who was famed for his piety and who became the second of the moral emperors. Consult Hirth, Friedrich, 'Ancient History of China' (New York 1911).

YAP, an island of the Caroline group, about 500 miles southwest of Guam. According to the Treaty of Versailles Yap went to the United States under a mandatory, while other German islands north of the Equator went to Japan. Yap is a cable station of the Commercial Pacific Cable Company. A cable is laid direct from Shanghai to Yap and there joins the main cable between Celebes and San Francisco. See CAROLINE ISLANDS.

YAPOCK, or YAPOK (also called YAPACH and OYAPOCK), a small, rat-like marsupial (*Cheironectes variegatus*) of the opossum family (*Didelphyidæ*), which is found in Central and South America. It is rather larger than a common rat, with large, naked ears, and a long nearly naked, tail; fur brown above, with three transverse bright gray bands, interrupted in the middle, white below. It differs from the opossums in having webbed hind feet and being an expert swimmer and diver. Its habits closely resemble those of the otter, and it feeds on fish, crabs and other aquatic animals.

YAPURA, yä-poo-rä', or **JAPURA,** zhä-poo-rä', also known as CAQUETA, a river in Columbia and Brazil, South America, a tributary of the Amazon. It rises in the Andes near Popayan and flows in a southwesterly direction, is about 1,800 miles long, and for about 620 miles of its course is navigable for steamers. At lat. 1° 10′ S. and Long. 72° 20′ W. navigation is interrupted by a large cataract.

YAQUI, or YAKI, a North American Indian tribe of Piman stock and of the Cahita division, living in the state of Sonora, Mexico, along the Yaqui River. They are industrious and are generally engaged in agricultural occupations and in weaving, although there are miners and pearl divers among them. They have the clan system of government and have always been determined enemies of the Mexican government, against which they have waged long and bitter warfare. Repeated wars have reduced the tribe from numbers which once reached 40,000 to about 13,000.

YAQUI, a river in Sonora, northwestern Mexico, with two head streams, both bearing the same name, one rising in New Mexico and one in Chihuahua. The confluence of the two streams occurs about 200 miles from the coast and the river then flows in a southwesterly direction and empties into the Gulf of California. It is about 500 miles long and is navigable at but few points, owing to the rugged, mountainous country and many cañons through which it flows. There are two rivers of the same name in Santo Domingo.

YARD. (1) As a nautical term, a spar slung from a mast and serving to extend a sail. Yards are either square, lateen, or lug sail; those for square sails are suspended across the mast at right angles, and are of a cylindrical form, tapering from the middle, which is termed the "slings," toward the extremities, which are called the "yard arms." (2) A standard measure of length, equal to three feet or 36 inches, the foot in general being made practically the unit. As a cloth measure the yard is divided into four quarters, equaling 16 nails. A square yard contains nine square feet, and a cubic yard 27 cubic feet. It was legalized in England in 1855, the previous legal measure, established in 1760, having been destroyed in the Houses of Parliament fire, 16 Oct 1834. A legend, exists to the effect that the original English yard was established by Henry I, and was the length of his arm. See WEIGHTS AND MEASURES.

YARKAND, yär-känd', Central Asia. (1) A city of Eastern or Chinese Turkestan, situated on the oasis of Yarkand, on the north side of, and at a little distance from, the river Yarkand, about 100 miles southeast of Kashgar, 3,900 feet above sea-level. It is enclosed by a ditch, and a thick mud wall with towers at intervals. The houses in general are built of sun-dried bricks. Those of the rich are in large open squares surrounded by high walls and well stocked with fruit-trees. The streets are in general too narrow to permit carts to pass. They are intersected by numerous canals, and where three or four streets meet there is always a tank for water. There is a large covered bazaar wide enough to admit carts. The inhabitants, like those of Kashgar, are very mixed in regard to race. The prevailing religion is Mohammedanism. There are 120 mosques and some caravanseries. During the period in which Eastern Turkestan was severed from China a commercial treaty was concluded at Yarkand in 1874 between Sir Douglas Forsyth, representing Great Britain and Yakub Beg, who was then the independent ruler of Eastern Turkestan. Commercial intercourse with India sprung up in consequence. The chief trade at present is carried on with Russia. Pop. 60,000 to 100,000. The oasis of Yarkand is one of the richest in Eastern Turkestan. It yields gold and precious stones and is rich agriculturally. It manufactures leather and saddlery, carpets, silk fabrics, and woolen and cotton goods. (2) A river of Eastern Turkestan, which rises in the Karakoram Mountains, flows generally in a northeast direction and unites with the Kashgar and Kotan-daria rivers to form the Tarim which flows east and enters the Lob Nor Lake, or series of shallow lakes.

YARMOUTH, Canada, a town and port of entry of Yarmouth County, Nova Scotia, on the Bay of Fundy, the Atlantic Ocean and the Dominion Atlantic Railroad, 90 miles south of Saint John, N. B. The town has extensive fishing, shipping and manufacturing interests, electric lighting and street railways. At the head of its educational institutions is Yarmouth Seminary. It is known also as a summer resort. Pop. about 6,600.

YARMOUTH, Me., town in Cumberland County, on Casco Bay, the Royals River and on the Grand Trunk Railroad; 10 miles northeast of Portland. It contains four villages and has a foundry, paper and cotton mills and granite quarries. The town has six churches, North Yarmouth Academy, a high school, graded schools and a public library. Pop. 2,358.

YARMOUTH, Great, England, a seaport town in the county of Norfolk, 22 miles east of Norwich, and 121 miles by rail northeast of London, on a narrow slip of land between the Yare and the sea. It is connected by a bridge over the Yare with Little Yarmouth, or South Town, in Suffolk, and is on the Great Eastern and the Midland and Northern railroads. The older part, near the river, is remarkable for its 145 narrow lanes at right angles to the main streets, known as the "rows" in which the houses were once the homes of the the wealthy burgesses. Between the older part of the town and the sea is the modern part, with a marine

parade and other attractions. The parish church, founded in 1101, is the largest parish church in England, being 230 by 112 feet; and the market-place is also of great size. There is an excellent town-hall, a large custom-house, an ample library and museum, a borough jail, a lofty Nelson monument, the royal hospital and royal naval lunatic asylum, the aquarium, two good piers and an ancient jetty. The North and South Quays stretch along the river for nearly two miles. The harbor is in the Yare, and is accessible by vessels drawing 18 or 19 feet. Immediately off Yarmouth, and parallel to the shore, is a great range of sand-banks, between which and the land is the safe anchorage of Yarmouth Roads. Yarmouth is the great seat of the English herring-fishery, in which about 300 vessels and 3,000 hands belonging to the port are employed; many are likewise engaged in the mackerel fishery, and in that for cod and other whitefish. Most of the fish are cured, the herrings known as "Yarmouth bloaters" being highly esteemed. There are malting-houses, boat-building yards, rope-works, silk-crape factories, trawl-net works, etc. Yarmouth has risen into considerable importance as a watering-place. It suffered from both air and sea raids during the European War. Area, 3,568 acres. Pop. about 55,905.

YARN, any textile before woven into cloth. Cotton yarn is numbered according to the number of "hanks" contained in a pound of 7,000 grains. Each hank, or skein, measures 840 yards. Worsted yarn has 560 yards to the skein; woolen yarn has 1,600 yards to the skein or run. Linen yarn is wound upon reels, and made up into leas, hanks and bundles. Flax and jute yarn is numbered according to the number of leas of 300 yards per pound.

YAROSLAV, yä-rō-slävʹ, or **JAROSLA**, Russia, (1) a city, capital of the government of Yaroslav, at the confluence of the Kotorost and Volga rivers, 173 miles northeast of Moscow. It is the see of an archbishop. The Uspenskij Cathedral was begun in 1215, and there are numerous other old churches, several monasteries, schools, gymnasia, a theological seminary, and a lyceum with a law faculty. The left bank of the Volga is the suburban and residential portion of the city and contains many beautiful dwellings. The city is chiefly engaged in manufacturing and commerce, the right bank of the Volga being lined for two miles with quays. There are numerous cotton and linen mills, silk factories and bell foundries. The city was founded in 1226–36 and was the chief town of a municipality in 1218–1471, then coming under the rule of Moscow. The village of Velikoje Selo, included in the city, was the centre of the linen manufacture of Russia, and had an annual output valued at $3,000,000. Pop. about 11,876. (2) The government had an area of 13,751 square miles, and is bounded by the governments of Novgorod, Vologda, Kostroma, Vladimil and Tver. It was one of the smallest but most thickly populated governments in Russia. The surface is level and well watered by the Volga and its tributaries, the Mologa and Sheksma. The western portion has numerous ponds and marshes, the largest being Lake Nero, near Rostov, from which the Weska flows. The Volga is connected with the Neva by two canals, through which considerable commerce is carried on. Market gardening, timber cutting, mining, flax, livestock and poultry raising and manufacturing are the chief occupations. There are extensive linen and cotton mills, and factories for the manufacture of chemicals, machinery, metal ware, flour, tobacco and spirits, making Yaroslav one of the principal manufacturing governments of Russia. Considerable commerce is carried on by the two railway lines, the Rybinsk-Petrograd and the Yaroslav-Moscow-Vologda. Its principal commercial cities are Rybrush and Yaroslav; while Rostov, Mologa, Romanovo and Poshekhon are important trade centres. Pop. about 1,239,300.

YARRA-YARRA, yäʹrą-yäʹrą, or **RIVER YARRA**, Australia, (1) river of Victoria on which Melbourne (q.v.) stands. It is about 100 miles long, but is not navigable above Melbourne, owing to its falls. (2) A lake of Western Australia, east of Darling Range and 150 miles north of Perth.

YARRELL, yärʹĕl, William, English naturalist: b. London, 3 June 1784; d. Yarmouth, Norfolk, 1 Sept. 1856. Led to note carefully the habits of birds and fishes in 1825 he sent his first contribution to the *Zoological Journal*, a notice of some rare British birds observed in the years 1823–25. The same year he became a Fellow of the Linnæan Society, to whose *Transactions* he repeatedly contributed interesting papers on the subject of birds, and in 1849 became its vice-president. His chief work is his 'History of British Birds' (2 vols., 1839–43; 4th revised edition 1881–85). He also published 'The History of British Fishes' (2 vols., 1835–36).

YARROW, Harry Crecy, American physician: b. Philadelphia, Pa., 19 Nov. 1840. He was educated in the schools of his native city and at Geneva, Switzerland, and in 1861 was graduated from the Medical Department of the University of Pennsylvania. His first service in connection with the Union Army was as examining surgeon for the Pennsylvania reserve corps. On 18 July 1861, he was regularly mustered in as assistant surgeon of the Fifth Pennsylvania cavalry, known as the "Cameron Dragoons." He was in action at Drancsville, Va., in December 1861, and several minor engagements, and the following month resigned to accept a position of acting assistant surgeon and executive officer in the United States army general hospital at Philadelphia, where he remained late in the year 1864, when he was detailed, with other surgeons, for service at Hilton Head, S. C., in anticipation of the fall of Fort Sumter. In July 1872 he resumed service with the Engineer Corps as surgeon and naturalist with the expedition for explorations west of the 100th meridian. In 1876 Dr. Yarrow was ordered to the Centennial Army Hospital at Philadelphia and in 1878 was assigned to duty, in the Army Medical Museum at Washington, where he remained until 1887. He was then attached to the Army Dispensary in Washington and was connected with that institution until 1898, when he resigned. In the meantime he was for 15 years honorary curator of the Department of Herpetology in the National Museum at Washington. He has been a member

YAZOO CITY, Military Operations at and near. Yazoo City was chosen by the Confederates as a site for a navy yard, at which were constructed some formidable iron-clads. Upon General Grant's approach to Vicksburg from the rear, in May 1863, the Confederates abandoned Haynes' Bluff, near the mouth of Yazoo River, upon which Lieut.-Commander John G. Walker, of the United States navy, went up the river with a small gunboat fleet to destroy all the works at Yazoo City. As the expedition approached the city, Lieut. Isaac N. Brown, of the Confederate navy, set fire to and destroyed three powerful rams which he had nearly completed, and upon which the Confederates were placing great dependence. Walker set fire to everything else of a public character, including the navy yard, containing five saw-mills, planing-mills, machine-shops, etc., and the expedition then returned. Early in June, Kimball's Union division was sent up the Yazoo to destroy the railroad bridge over the Big Black near Canton; but upon arriving at Mechanicsburg, Kimball found a large Confederate force in his front at Yazoo City and Liverpool, and as the river, on which he depended for supplies, was rapidly falling, he returned to Haynes' Bluff. After the surrender of Vicksburg, 4 July 1863, a report reached General Grant that Gen. J. E. Johnston was fortifying Yazoo City, and that a number of steamers were at the place, employed in supplying his troops. A naval and military expedition was organized to capture or destroy the steamers and take the place. Four vessels, under Lieut.-Commander Walker and 5,000 men under Gen. F. J. Herron, in transports, went up the Yazoo from Haynes' Bluff 12 July, and approached Yazoo City at noon next day; the Confederates were reported in force, and the iron-clad gunboat *De Kalb* was pushed ahead and opened her guns to ascertain the number and position of the enemy's guns. The Confederates had a battery of six heavy guns and the town was held by the 29th North Carolina infantry. Finding the defenses formidable, Walker dropped back and notified Herron, who at once landed his troops and a combined attack was made. After a slight skirmish on shore the Confederates fled, previously setting fire to four large steamers. Six heavy guns and one steamer fell into Union hands. Herron captured nearly 300 prisoners. While the *De Kalb* was moving slowly along and firing on the enemy, she ran on a torpedo and sank in 15 minutes. All on board were saved. Herron destroyed all public property, captured about 2,000 bales of cotton and returned to Vicksburg 21 July.

On 3 Feb. 1864, in co-operation with General Sherman's Meridian expedition (q.v.), a combined expedition of gunboats and transports with troops was sent up the Yazoo River from Vicksburg, with instructions for the gunboats to explore Yazoo and Sunflower rivers and all their tributaries. The gunboats were five in number, under command of Lieut.-Commander Owen, United States navy. Five transports conveyed the 11th Illinois and 8th Louisiana (colored) infantry and 35 colored cavalry, in all 982 men, under command of Col. James H. Coates, who was instructed to reconnoitre above Yazoo City and to obtain corn and forage on the Sunflower or on the Yazoo, and also to seize at least 1,000 bales of cotton and to destroy all flats or boats used to cross from the east to the west. From its start the expedition was annoyed by Gen. L. S. Ross, who, with a brigade of about 1,200 men, was guarding the Yazoo River and the Mississippi Central Railroad, and who, on 3 February, opened fire with artillery upon one of the gunboats when near Liverpool Heights. Coates landed his men, had an indecisive fight with Ross in which he lost six killed, 21 wounded and eight missing, and at night withdrew to his transports. Next morning the expedition, under fire of Ross' artillery and musketry, passed up the river, the gunboats clearing the way to within four miles of Yazoo City, where it remained until 6 February when two gunboats, having been ordered to reconnoitre, reported that the place was occupied in force, with five guns in position and another in course of erection. The guns opened, two shots taking effect on one of the gunboats, and the gunboats and transports fell down the river below Satartia, where, on the morning of 7 February, Coates disembarked his entire command, drove back some Confederate skirmishers and at night withdrew to his transports. On 8th February the expedition again pushed up the river, two gunboats passed the city and the transports landed their men within a mile of it. Next day Coates took possession of the city, and on 11 February moved up the river, arriving at Greenwood on 14 February, where he remained until 19 February, gathering cotton, corn and forage. He then received orders to fall back to Yazoo City. On 28 February when within six miles of the place he ordered his small force of cavalry to move in rear of the city and take possession of all roads leading out of it. That afternoon he landed at Yazoo City and took position in some redoubts commanding the roads. Major Cook, with 50 colored cavalry, was sent toward Benton. When nearly six miles out Cook ran into Ross' brigade, by which he was roughly handled and pursued nearly to the city, losing eight killed, 35 wounded and 10 missing. Coates' pickets were much annoyed and on the morning of 5 March were driven in. Ross had been joined by Gen. R. V. Richardson's Tennessee brigade of about 600 men and at 10 o'clock the two brigades, about 1,600 men, making a determined attack, forced portions of the Union line and gained the streets of the town. At the same time they used artillery upon the redoubt, on the Benton road beyond the town, which, with the adjacent rifle-pits, was held by a part of Coates' command and repulsed all Confederate effort to carry. At 2 P.M. Coates, with those who were not in the redoubt, made a charge through the streets and the Confederates withdrew and gave up the attempt upon the redoubt. The Union loss in the engagement was 19 killed, 80 wounded and 18 missing. The Confederate loss was six killed and 51 wounded. On the evening of 6 March Coates started on his return to Vicksburg. He took with him over 1,700 bales of cotton and much corn and forage. The total loss of the expedition was 31 killed, 121 wounded and 31 missing.

On 19 April 1864 a small detachment of a colored brigade, under command of Col. H. Scofield, marched from Vicksburg for Yazoo City and two gunboats went up the river to co-operate in an attack on the city. Scofield skirmished sharply with a part of Gen. Wirt Adams' brigade and on the night of 20 April bivouacked 15 miles below the city. On 22 April the gunboat *Petrel* in attempting to run past Yazoo City in order to fire upon the works from above, was fired upon by a section of artillery and a detachment of sharpshooters of Adams' brigade. The men were driven from the guns, the crew from the boat, and most of them captured, including Acting Master McElroy. The Confederates seized the boat, removed her eight guns and burned her. Next morning the expedition returned to Vicksburg.

E. A. Carman.

YAZOO FRAUD, The, a name given to the sale of lands in the western part of Georgia by a corrupt legislature, to certain large companies in 1789. This action caused great excitement and bitter controversy until settled by the United States Supreme Court in 1810.

YAZOO PASS AND STEELE'S BAYOU EXPEDITIONS. In the Civil War after the battle of Chickasaw Bayou, 29 Dec. 1862, and the capture of Arkansas Post, 11 Jan. 1863, General Grant ordered the army to Young's Point and Millikin's Bend, where he took command in person 30 January. Work on the projected canal across the peninsula opposite Vicksburg was pushed, but on 4 February Grant questioned its success, and began to look for other routes by which the army could reach the high ground either north or south of Vicksburg. Two projects were considered. One involved cutting away from the Mississippi into Lake Providence from a point 70 miles above Vicksburg. This lake, a former bed of the river, was connected by Bayou Baxter with Bayou Macon, a navigable stream, which led to the Tensas, thence into the Washita, and finally into the Red River. Thus it was hoped the army could be transported to the lower Mississippi to co-operate with Banks against Port Hudson. It is 470 miles by the main river from Lake Providence to the mouth of Red River, and much farther by the winding bayous. Upon the cutting of the levee at Lake Providence the water from the river flowed in rapidly and the six miles of the lake beyond were soon available. But Bayou Baxter was found choked for miles with fallen trees and a thick growth of timber overhanging it. General McPherson's entire corps was engaged for some time in attempting to open this channel and those below it. In March this project was abandoned.

On the east side of the river, a few miles below Helena, was Yazoo Pass. This had formed the old route of river steamers through the Coldwater to the Tallahatchie, and the Yallabusha to Yazoo City, but it had been closed for some years by a strong levee. By reopening this route it was believed to be possible to reach the high ground on the Yazoo bluffs north of Vicksburg. This Yazoo Pass plan promised greater success than the Lake Providence scheme. Under Lieut.-Col. Wilson of the engineers, later Maj.-Gen. James H. Wilson, the levee was cut 2 February, a way was cleared to the Coldwater, and the Pass opened to navigation on 24 February. Brig.-General Ross, with 4,500 men, was ordered into the pass upon light draft transports, and, preceded by gunboats, penetrated by that stream to the Tallahatchie, and thence to the Yallabusha, where the expedition, after an advance of 225 miles, was stopped 11 March by Fort Pemberton, near the juncture of the last-named streams. It was a strong work in a bend which commanded both. The fort was found to be so situated that in this time of high water neither troops nor gunboats could reduce it although the gunboats attacked on 11 and 12 March. As it stood only a few feet above the water, attempts were made to flood it by cutting the levee at Austin above Helena, and widening the cut into Yazoo Pass. These were unsuccessful. The expedition, after several attempts on the fort, withdrew. On the way back a reinforcement under General Quimby was met, 22 March, and this officer ordered a return to Fort Pemberton for further efforts. He soon became satisfied that the fort could not be reached, and ordered final withdrawal. The gunboats could not turn in the narrow channels and were forced to back out over a large part of the route. General McPherson's corps had been ordered into the pass, but was delayed for lack of light draft transports and later the intended movement of the army by that route was abandoned. Meantime the Confederates had gathered a strong land force under W. W. Loring, which became first harassing and soon after most threatening. Sherman, preceded by five gunboats of Admiral Porter's fleet, was dispatched in haste 16 March through Steele's Bayou, by which route it was hoped he could reach the Yazoo, relieve Ross, then supposed to be in danger of capture, and at the same time find a practical way for the army into the Yazoo. Sherman had a winding and difficult route of 150 miles before he could reach that stream. From Steele's Bayou, which he entered at Eagle Bend, he passed to Black Bayou and thence to Deer Creek. This opened into Rolling Fork by which he could enter the Big Sunflower, and by this stream reach the Yazoo. Even with the tremendous energy of his advance Sherman was barely in time to save the gunboats which had been attacked in Deer Creek by land forces, and were so hard pressed that Admiral Porter was considering the blowing up of his fleet and retreating with his crews through the swamps. These several attempts through the bayous east and west of the river had been carried on over hundreds of miles and against the most formidable obstacles of flooded country, dense forests and heavily obstructed streams. They were finally abandoned and the army reassembled at Millikin's Bend and Young's Point. From this position the army subsequently moved in the final campaign against Vicksburg.

H. V. Boynton.

YEAR, the period in which the revolution of the earth round the sun, and the accompanying changes in the order of nature, are completed. The accurate determination of the

length of the year, which required great knowledge of astronomy and exact observations, could only be reached by the successive efforts of many generations. (On this subject see CALENDAR). There are years of various lengths, according to the principle adopted in measuring them. The sidereal year is the interval that elapses while the sun moves from a star to the same star again (of course this motion is only apparent), a period the length of which is slightly affected by nutation, but on the average is equal to 365 days, 6 hours, 9 minutes, 9.6 seconds. The tropical or civil year, sometimes called the solar year, is the time in which the sun moves from the vernal equinox to the vernal equinox again; its mean length is 365 days, 5 hours, 48 minutes, 49.7 seconds. This is the year as commonly understood. On account of the precession of the equinoxes it is rather shorter than the true period of the earth's revolution. A lunar year is the time required for 12 revolutions of the moon, which is 354 days, 8 hours, 48 minutes, 37 seconds. Bisextile, or leap year, is a calendar year to which one day is added, making 366 days instead of 365. February of a leap year has 29 days. A light year is a linear measure used by astronomers to measure the distances of intrestellar space. See also DAY; SIDEREAL TIME; SOLAR TIME.

YEARDLEY, yērd'lĭ, or **YARDLEY, SIR George,** American colonial governor: b. England, about 1578; d. 1627. After seeing service in the Netherlands he came to America in command of Sir Thomas Gates' expedition. This was wrecked at the Bermuda Islands, but he reached Virginia in 1610 and was acting governor of the Virginia colony 1616–17. Returning to England the next year he was there knighted and chosen deputy governor of the colony, filling the office in 1619–21. By his instructions was summoned the first legislative assembly ever gathered in America, the House of Burgesses. The company was dissatisfied with his administration and he was succeeded by Wyatt. He remained in the colony where he served on the council and in 1626 Charles I again made him deputy governor.

YEAR'S MIND. See MONTH'S MIND.

YEAST, or BARM, is a micro-organism of the vegetable kingdom and belongs in the order of the *Gymnoascea* to the family of the *Saccharomycetes,* of which there are three classes, namely, *Monospora, Saccharomyces* and *Schizosaccharomyces.* The main characteristic of the first class, as its name indicates, is that it only develops one spore in the ascus. Thus far only one type, the *Monospora Cuspidata,* which is parasitic in *daphiniadæ* which it destroys, has been determined. There are many representatives of the second class, while only a few of the third have up to the present time been identified. The second class — the *Saccharamyces* — is generally what is understood under the term yeast, not only in the brewery but also in the distillery and the compressed yeast fabrication. Its structure is very simple; it consists of a single cell, which has few distinguishing characteristics. Each cell of the saccharomycetes is more or less globular or ovoid in form and, just as every other vegetable cell, consists of a colorless, viscous substance (protoplasm), a cell-wall (membrane), and also a nucleus. In the protoplasm there are observed, according to the species of the plant cell, different numbers of spaces filled with cell-juice, which are termed vacuoles.

In young yeast cells the cell-wall, or membrane, is very thin — 0.4 to 0.9 μ — and has almost the same refractive power as the protoplasm which it surrounds. The membrane is thickened through external influences, especially when the yeast-cells must develop in or upon a highly nutritious medium. An increase in the thickness of the cell-wall is also accompanied by greater impermeability and a corresponding decrease in the fermentative capability of the cell. Through the action of acids or alkalies upon the yeast cell the layers of the cell-wall can be shown, which are two, and sometimes three, or even more in number. Chemically the membrane of the yeast cell consists of cellulose (erythro and achroo-cellulose), pectinic compounds, and plasmatic components, for which reason it is very nitrogenous. The cell contents consists of protoplasm with more or less glycogen. (According to Laurent there is 32.28 per cent glycogen in the dry substance.) In the young yeast cell the whole interior is filled with protoplasm; in a short while, however, apparently hollow spaces appear, which are filled with the reserve nourishment necessary for the vitality of the cells. The nucleus furnishes the substances necessary for building up the cell, and, according to its chemical composition, belongs to the albuminoids in the class of the *proteids,* and especially to the nucleins. The form of the nucleus varies considerably; in a young cell it is spheroid, flattens out with increasing age to a disc whose periphery is no longer entire, but is lobed; elliptical shapes were also found.

The nucleus is in some instances of a considerable size; its diameter in some cases being one-third of that of the cell. Concerning the inner structure of the nucleus it was observed that the nucleus of the yeast cell has a pellicle as well as a nucleolus, which is spheroid, and is situated in approximately the centre of the nucleus, the space between the pellicle and the nucleolus being filled with nucleus plasma (*Karyoplasma*), this having a netlike structure through which the nucleolus is suspended. One or more vacuoles were observed in several types of yeast in the Karyoplasma under certain conditions, especially when the cells were transferred into fresh nutrient solutions. With the beginning of the propagation of the cell a corresponding development of the nucleus takes place, in either one of two ways, that is, the direct division (Amitosis), or the indirect division (Karyokinesis, Mitosis). The manner in which the nucleus divides itself differs in the various types of yeast. The yeast cell is propagated in one of two ways, either through oxygen spore formation, budding, or through endogen spore formation, the real sporulation.

In the former case a new cell is detached from the parent cell, while in the latter the new cells (spores) are formed inside the parent cell, which it leaves only upon complete maturity. Several recent investigators are inclined to believe in the sexuality of yeast, and close research

the decrease in the density of the nutrient medium due to fermentation. The attenuation reached by a yeast in a diastase-free beer wort has been agreed upon as the limit, and in accordance therewith the brewers' yeasts are graded, and we have the Frohberg type with high attenuation, and the Saaz with low attenuation. Van Laer has defined a new type, Logos, so that now we have the types Saaz-Frohberg and Frohberg-Logos, with all intermediate grades. The numerous wine yeasts vary according to their resistibility against heat and acids; the amounts of sugar produced by them, and the amount of fruitesters, which they impart to the liquid. The distillers' yeasts, mostly top yeasts, are known by their resistance against acids, and foreign ferments, through their fermentative capability and the amount of alcohol developed.

No one can deny that yeast induces alcoholic fermentation, but how this is accomplished is still a matter of controversy. Liebig and other chemists maintain that fermentation is called forth by a ferment contained in the yeast cell, while Pasteur deems it the necessary consequence of life without oxygen. Naegeli claims it to be a transferring of the motion of molecules of protoplasm of the yeast to the fermenting liquid. Eduard Buchner and Rudolf Rapp of Munich discovered in the yeast cell a fermentation-inciting enzyme — zymase — which, however, can only induce fermentation once after the cell is completely destroyed. This discovery, which is of much scientific import, has not yet been made applicable in practical arts.

Besides the culture yeasts, there are a number of wild yeasts, which can produce great disturbances in the liquids infected by them. In order to avoid such infection by wild yeasts and also by bacteria, Hansen experimented and succeeded in preparing a pure yeast culture, that is, a culture originating from a single cell. Such a culture is not only free from all wild yeasts and bacteria, but also can and does remain unchanged as all cells are of the same nature. A reliable fermentation process can only be obtained by the use of one single type.

Such pure cultures are variously prepared; the oldest and best known method is that of Hansen, which has recently been modified by Dr. Lindner of Berlin as the droplet-culture. Both investigators employ for the further development of the young vigorous cultures the propagation apparatus, which when once supplied with an absolutely pure culture can be used for a long time if proper care is observed. Upon this pure-culture method a new brewing process is based which permits of entirely sterile work from boiling the beer to the putting it on the market. This process, invented by Nathan, has been called by him in honor of Hansen, the senior in the art of pure culture, the Hansena process. Another method to obtain yeast of a high degree of purity is that in which a mixture of yeast is exposed to definite conditions of temperature, aeration, kind of nutrition, action of light, pressure and motion that *one* yeast of definite properties develops more and better than the other yeasts in the mixture. If, further, the corresponding layer is removed from the yeast and propagated under the aforesaid conditions, a pure yeast of a uniform character is finally obtained. This process, founded by Delbrueck of Berlin upon his scientific observations in American breweries, was further elaborated by him. An idea of the importance and value of pure yeast culture can be had from the fact that almost all the larger breweries and distilleries employ apparatus for propagation and endeavor through observing the utmost care to protect their yeast against infection. But yeast is not only of great import to the brewer and distiller, but also to the baker, as the quality of his wares depends upon the quality of the yeast used, and in consequence thereof a special industry, that is, the manufacture of compressed yeast, has been introduced. Compressed yeast is chiefly made from distillers' yeasts; but in some instances also, beer yeasts, which must be purified and disembittered, are utilized. The price of compressed yeast in comparison to beer yeast is considerably high, but the baker has the advantage that by using the former his wares obtain a larger size than when the latter is used. The process of fermentation with compressed yeast develops more slowly than with beer yeast, hence the dough requires more time to ripen. Much progress has been made in the compressed yeast fabrication and diverse methods are employed in its manufacture. Many operations must be carefully and accurately observed in order to obtain a salable product. In the main these operations are: (1) Preparation of a fluid in which the yeast can properly develop, either under simultaneous formation of alcohol or without the formation of much alcohol; (2) preparation of a mass, in which there is a corresponding amount of vigorous seed-yeast, which is added to the above-mentioned fluid (preparation of the mother-yeast); (3) bringing together of the nutrient medium with the stock yeast or "setting"; (4) reproduction of the yeast with or without simultaneous fermentation; (5) separation of the newly formed yeast from the fluid by skimming, etc.; (6) washing the yeast, or removing the last traces of the nutrient medium; (7) pressing of the washed and separated yeast mass; (8) forming the compressed yeast into cakes of suitable size; (9) packing of the cakes for the trade and for shipping.

For some time yeast, especially beer yeast, has been used in medicine, and has been successfully employed partly fresh and partly dried, in tablet form in cases of furunculosis, flemonen, acne, psoriasis, and other skin diseases, dyspepsia and partly in diabetes. See BREWING.

YEATS, William Butler, Irish author: b. Dublin, 13 June 1865. He obtained a secondary schooling in England and Ireland, was for three years a student of art, but turned to literature in 1886. He was a leader in the foundation of the Irish Literary Society and the National Literary Society of Dublin, and a prime mover in the Irish Independent Theatre, thus becoming one of the chief representatives of the Irish Literary Revival. Yeats has no superior as a lyric poet in his generation, but he is perhaps best known as a playwright. After a few years spent in the literary circles of London and Paris he returned to Ireland about 1896 and devoted himself assiduously to literature, drawing largely on Gaelic myth, legend and folklore. In 1903–04 and again in 1914 and 1903 he lectured in the United States on subjects connected with this movement. With E. J. Ellis

he edited 'The Works of William Blake' (1893) and 'Ideas of Good and Evil' (1903). Among his various further publications in prose and verse are 'The Wanderings of Oisin' (1889); 'John Sherman' (1891); 'Countess Kathleen' (1892); 'The Celtic Twilight' (1893); 'A Book of Irish Verse' (1895); 'Poems' (1895); 'The Secret Rose' (1897); 'The Wind among the Reeds' (1899); 'The Shadowy Waters' (1900); 'Cathleen ni Hoolihan' (1902); 'Ideas of Good and Evil' (1903); 'In the Seven Woods' (1903); 'Hour Glass and Other Plays' (1904); 'The King's Threshold' (1904); 'Deirdre' (1907); 'Collected Works' (8 vols., 1908); 'Green Helmet and Other Poems' (1910); 'J. M. Synge and the Ireland of his Time' (1911); 'Plays for an Irish Theatre' (1912); 'Responsibilities' (1914); 'Reveries' (1916). Consult the autobiographical 'Reveries' (1916); Gregory, 'Our Irish Theatre' (New York 1913); Kraus, W. S., 'William B. Yeats' (ib. 1904); Moore, George, 'Hail and Farewell' (3 vols., ib. 1912–14); Reid, Forrest, 'W. B. Yeats' (ib. 1915); Weygand, Carl, 'Irish Plays and Playwrights' (ib. 1913).

YEDO, yĕd'ō. See TOKIO.

YELIZAVETPOL, Russia. See ELIZAVETPOL.

YELLOW, one of the prismatic colors; the color of that part of the solar spectrum situated between the orange and the green; a bright golden color, the type of which may be found in the field buttercup, which is a pure yellow. United with blue it yields green; with red it produces orange.

YELLOW-BASS, PERCH, etc. See BASS, PERCH, etc.

YELLOW BAYOU, Engagement at, and Banks' Retreat from Alexandria. General Banks arrived at Alexandria, La., on his retreat from Sabine Cross Roads, 25 April 1864. Three days later General Hunter handed him an order from General Grant to close up the campaign against Shreveport without delay and return A. J. Smith's troops to General Sherman, for operations east of the Mississippi. Hunter returned with a letter from Banks to Grant with the information that Porter's fleet was above the Alexandria Rapids in a critical situation should the army abandon it. As to the further prosecution of the Shreveport and Texas campaign that was not to be thought of, and Banks turned his attention to getting Porter's fleet below the rapids. These falls were a mile in length, filled with rugged rocks, which at the time were nearly bare. As the vessels needed at least seven feet of water to float them, they seemed to be doomed. The plans for their release were suggested and executed by Lieut.-Col. Joseph Bailey of the Fourth Wisconsin Cavalry. The work began on 30 April, nearly the entire army at different times being detailed for the duty; 2,000 to 3,000 lumbermen from Maine and the Northwest cut down trees; others were set to collecting stones, bricks, etc., including whole houses and sugar-mills with all their machinery and kettles, and in a week a dam of timber and stone, with sunken barges in the centre, had been constructed across the river, 758 feet in width, raising the water from five to seven feet deep on the rapids. The work had been prosecuted day and night, the men working up to their waists and exposed to a hot sun. The water having risen, three gunboats and another vessel ran down the rapids on the afternoon of 8 May and lay to just above the dam. Early in the morning of the 9th two of the barges broke loose, making a gap in the dam 66 feet wide, through which the water rushed in a great torrent, and the four vessels went down safely through the opening. Six gunboats and two tugs were still above the rapids, waiting for a higher rise in the water. The damage to the dam was partially repaired and wing-dams were constructed on the upper falls, which shed the water from either side into the channel between them. They were completed by the 11th, when the water had risen to six and a half feet. Meanwhile the heavier vessels had been lightened by stripping from them their armor-plates and landing some of the heavy guns, ammunition, chain cables, anchors and provisions, and on the 12th all the vessels had run down the falls and through the dam into deeper water. Meanwhile the Confederates had gotten in Banks' front, south of Alexandria, and taken position on the river 25 miles below the town, where 1 May they captured and sunk a transport, and on the morning of the 3d captured a transport, on her way up the river with 425 men of the 120th Ohio on board. Some of the men were killed and wounded, all the officers and 270 men were captured. On the evening of the 4th another transport carrying 400 men of the 50th Ohio, while going down the river, convoyed by the gunboats *Signal* and *Covington*, was attacked by artillery and musketry, and the gunboats went to her assistance. About 125 men on the transport were killed and wounded; she was soon disabled; the *Covington*, after losing more than half her men, was abandoned and burned; the *Signal* also was disabled and, with the transport, surrendered. No further attempt was made to run the blockade, and for two weeks Banks' communication with the Mississippi was closed. The fleet having passed below the falls and the river rising insuring a safe passage of all the bars below, the gunboats and transports started on the morning of the 13th of May, and in the afternoon Banks marched out of Alexandria for Simsport. From the start his front, flanks and rear were harassed by cavalry and artillery, and on the 16th he had a severe engagement near Mansura, in which the Confederates were driven from position they had taken across the road to Simsport, which place his advance reached on the evening of the 17th. Here it was found that the pontoon-bridge was too short to span the Atchafalaya and Colonel Bailey again improvised a crossing. The transports were ranged side by side across the river, with the planking of the pontoons laid across their bows, making a level road of about 700 yards, over which the main body of the army with its trains and artillery began passing on the 19th. While this bridge was under construction A. J. Smith's command was drawn up in line at Yellow Bayou, covering the rear of the army and the crossing of the Atchafalaya. Here Smith's troops were attacked on the afternoon of the 18th by General Wharton's cavalry and General Polignac's infantry. Smith's skirmishers were driven in, and at first the Confederates gained some advantage; but General Mower, who was in immediate command of the Union line, made

a counter-charge with two brigades of infantry and one of cavalry and the Confederate attack was repulsed. In endeavoring to follow up his success Mower was checked by a heavy artillery fire, and withdrew to a thicket, where he formed a new line and brought up artillery. The Confederates renewed the attack and were repulsed with some loss. The thicket now took fire and made an impassable barrier between the two sides, and Mower withdrew, leaving his dead and wounded on the field. The Union loss was 38 killed, 226 wounded, and three missing; the Confederate loss, 452 killed, wounded and missing, of whom 180 were taken prisoners. The army had all crossed the Atchafalaya on the 20th. Banks yielded the command to General Canby, who had been ordered to relieve him; the navy and transports passed into the Mississippi; and the Red River campaign, one of the most humiliating of the war, had ended. On the return march from Alexandria the Union loss was about 165 killed, 650 wounded, and 450 captured or missing. General Taylor says the Confederate loss in the entire campaign, from Sabine Cross Roads to Yellow Bayou, was 3,976. Consult 'Official Records,' Vol. XXXIV; Taylor, 'Destruction and Reconstruction'; Mahan, A. T., 'The Gulf and Inland Waters'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. IV.

YELLOW BOOK OF FRANCE, a government publication issued regularly since 1861, designed to furnish historians and others with official information. It is similar to the British Blue Book and the German White Book. Several publications of this type were issued by the belligerents during the Great War of 1914–18; many of these were merely propaganda designed to influence public opinion in neutral states.

YELLOW COPPERAS, a name sometimes used for the mineral copiatite. Crystallization, monoclinic, usually in translucent pearly yellow plates; hardness, 2.5; composition, a basic sulphate of iron; specific gravity, 2.1. Found near Copiapo as an incrustation on coquimbite; also in other places in South and North America.

YELLOW-EYED GRASS, the common name of the genus *Xyris*, composed of rush-like plants, with bright yellow flowers produced from the summit of a naked scape, conspicuous in sandy bogs in July and August. They are mostly of tropical distribution about the world. The common yellow-eyed grass (*X. flexuosa*) has a bulbous root; equitant, linear, twisted leaves; an erect, two-edged, twisted scape; roundish, acute heads, supporting a number of small yellow flowers projecting from between the scales, with perianth and other parts of the flowers in threes. Another species with pretty, large petals (*X. caroliniana*), occurs near the sea from Rhode Island southward. *X. fimbriata*, a plant two feet high, the divisions of its calyx conspicuously fringed on the wing-margined keel, and plumose at the summit, is found in the pine barrens of New Jersey and southward. The foliage and roots of *X. indica*, of *X. americana*, and of *X. vaginata*, are used for a remedy for leprosy and the itch, in India, Guiana and Brazil.

YELLOW FEVER is an acute infectious disease which is transmitted from the sick to susceptible individuals through the agency of mosquitoes. The yellow fever mosquito (*Stegomyia fasciata*) is found in tropical and semi-tropical regions, and especially in lowlands near the sea or in river valleys. This mosquito serves as "an intermediate host" for the yellow-fever parasite, which is present in the blood of those sick with the disease during the first three days of the attack. After filling itself with blood from a yellow-fever patient a period of 12 days is required for the development of the parasite in the body of the mosquito before it can transmit the disease, by its sting, to another individual.

These facts have been established by the experiments of a board appointed upon the recommendation of the writer, in 1900, for the study of yellow fever in the island of Cuba. The late Maj. Walter Reed, surgeon United States of America, was president of this board, and the success attained is largely due to his carefully made plans and their intelligent and conscientious execution by himself and his associates.

In a "preliminary note" read at the meeting of the American Public Health Association, 22 Oct. 1900, the board gave a report of three cases of yellow fever which they believed to be the direct result of "mosquito inoculations." Two of these were members of the board, namely, Dr. Jesse W. Lazear and Dr. James Carroll, who voluntarily submitted themselves to the experiment. Dr. Carroll suffered a severe attack of the disease and recovered, but Dr. Lazear fell a victim to the disease and to his enthusiasm in the cause of science and humanity. Fortunately no other deaths occurred during the subsequent experiments which Major Reed found it necessary to make in order to establish the fact that yellow fever is, beyond question, transmitted by mosquitoes of the genus *Stegomyia*, and in no other way. In a report made in May 1901, Major Reed says: "We have thus far succeeded in conveying yellow fever to 12 individuals by means of the bites of contaminated mosquitoes." These experiments were made upon individuals who volunteered to submit themselves to the mosquito inoculations with a full knowledge of the possibility of serious and even fatal results. Some of the volunteers were United States soldiers, and some were Spanish immigrants who had recently arrived in Cuba. Further experiments showed that blood drawn from a yellow-fever patient during the first three days of the disease and injected by means of a hypodermic syringe beneath the skin of a susceptible individual gives rise to a characteristic attack of yellow fever in the inoculated individual. But all attempts to demonstrate the specific infectious agent (yellow-fever parasite) in the blood or in the bodies of infected mosquitoes have been unsuccessful. This is probably due to the fact that the yellow-fever parasite is so small as to be practically ultra-microscopic. This inference is supported by experiments made in Cuba by Assistant Surgeon James Carroll, United States of America, a member of the board heretofore referred to. Dr. Carroll found that when blood taken from the circulation of a yellow-fever patient was passed through a Berkefeldt filter

a small quantity of the filtrate injected under the skin of a susceptible person gave rise to a typical attack of the disease.

The experimental results obtained by Major Reed and his associates have been fully confirmed by several independent investigators, including a board of experts from the Pasteur Institute of Paris, who were sent to Brazil to make researches with reference to the etiology of this disease.

Having ascertained that yellow fever is transmitted from man to man by an intermediate host — mosquitoes of the genus *Stegomyia*, Major Reed and his associates conducted a series of well-planned experiments for the purpose of ascertaining whether the disease may also be propagated, as has been commonly supposed, by clothing, bedding and other articles which have been in use by those sick with the disease. The results of these experiments were entirely negative. That is, all efforts to communicate the disease to susceptible individuals through the medium of such articles were without result.

In view of what has thus far been said it is evident that the preventive measures which were formerly relied upon to arrest the epidemic extension of this infectious disease were either of no avail or of comparatively little value. Isolation of the sick from contact with non-immune individuals is not necessary, but protection of the sick, by mosquito-bars, from the bites of mosquitoes is all-important. Disinfection of clothing and bedding is of no avail, but the destruction of infected mosquitoes, by sulphur fumigation or otherwise, is an essential measure of prophylaxis. Street cleaning and municipal sanitation generally have no material effect in preventing the extension of this disease, except in so far as they result in destroying the larvæ and breeding places of mosquitoes. Applying the knowledge gained by Major Reed and his associates in a practical way, as above indicated, the medical officers of the United States army stationed in Cuba have been able to completely eradicate yellow fever from the city of Havana, which had been the principal endemic focus of the disease for many years; and sanitarians feel confident that by the application of the same methods the epidemic extension of the disease within the limits of the United States, or elsewhere, may be entirely prevented. Thus has yellow fever, which formerly ranked with cholera and bubonic plague,— although having a more restricted area of prevalence,— as one of the most fatal scourges of the human race, been robbed of its power for mischief by the painstaking researches of scientific investigators. The limits of the present article only permit a brief reference to the history of the disease under consideration. It has a comparatively restricted geographic range, but there is every reason to believe that this might be greatly extended if cases of the disease should be introduced to all of the regions where the intermediate host (*Stegomyia fasciata*) of the "yellow-fever germ" is found. That the disease has not been introduced into regions remote from its principal endemic foci is probably due to the comparatively brief duration of the attack, to the fact that the infectious agent is only present in the blood during a brief period (three days) and to the circumstance that it cannot be transmitted in any other way than by inoculation — either directly, as in the experiments of Reed and his associates, or through the medium of an infected mosquito. Epidemics have occurred in the United States at all of our principal seaports on the Gulf of Mexico and on the Atlantic Coast as far north as Boston. It has also invaded many of the Southern States, prevailing as a widespread epidemic in the interior, and has extended up the valley of the Mississippi as far as Saint Louis. It has been epidemic at all the principal seaport cities of the West Indies, of Mexico, of Central America and of South American countries bordering upon the Gulf of Mexico; also upon the Pacific Coast of Mexico and South America and in the Atlantic-Coast cities of Brazil and also of Argentina. The cities of Havana, Vera Cruz and Rio de Janeiro were long regarded as its principal endemic foci. The climate of these cities is favorable to the survival of the *Stegomyia* throughout the year. Consequently, when once introduced, the disease continued to be propagated through a series of cases, occurring successively without regard to seasons. Thus it was ascertained by the Yellow Fever Commission, of which the writer was a member (1879), that during the 10 years from 1870–79 there was not a single month without some recorded deaths from yellow fever, and this continued to be the case until the disease was eradicated in 1901 by the well-directed efforts of Colonel Gorgas, of the medical department, United States Army. In his report as sanitary officer of the city of Havana for the month of November 1901, he says: "Last year (1900) we had, during this month, 214 cases and 54 deaths. This year the last case of yellow fever occurred on 28 September; that is, we have gone over two months without a single case or death belonging to Havana." . . . "This result I consider due to the system, introduced last February, of killing infected mosquitoes in the neighborhood of each point of infection as it developed." The introduction of yellow fever into the previously healthful city of Havana is recorded by the historian Pezuela, as follows: "Although Havana is situated on the northern boundary of the torrid zone, it was very justly considered one of the most healthy localities on the island before its invasion, in a permanent manner, by the *vomito negro*, imported from Vera Cruz in the summer of 1761. In May there came from Vera Cruz, with materials and some prisoners destined for the works on the exterior fortifications of Havana, the men-of-war *Reina* and *America*, which communicated to the neighborhood the epidemic known by the name of *vomito negro*. At the end of the following June there were stationed in this fort nine men-of-war, despatched from Cadiz, and sent to the chief of squadron, Don Entienne de Hevia; they brought a reinforcement of 2,000 men. More than 3,000 persons succumbed to the epidemic on this, the first appearance of the *vomito*."

History also records the first introduction of the disease to the city of Rio de Janeiro. The highest medical authorities in Brazil agree that yellow fever was not endemic in the principal seaports of the empire prior to the year 1849, when it was introduced to the city of Bahia by the North American brig *Brazil*,

likely to recover from an attack than the temperate, and a recent debauch is a recognized predisposing cause.

The mortality among children is considerably less than among adults. This applies especially to children from 5 to 15 years of age. The mortality among children under five is somewhat greater.

The idea which formerly prevailed in New Orleans and Havana that native-born citizens — "creoles" — have an inherited immunity from the disease is not well founded. Whatever immunity they may enjoy is no doubt, to a great extent at least, due to an attack of the disease frequently occurring during childhood and usually unrecognized.

Hinemann writes with reference to Vera Cruz: "Until lately the physicians and people of Vera Cruz supported with fanaticism the dogma that natives were absolutely exempt from yellow fever. But the fearful epidemics of recent years (1875, 1877, 1878) have worked a change; for so many native children and adults suffered, that the truth could no longer be denied that these do not enjoy an absolute immunity."

In Cuba the dogma that creoles are exempt from yellow fever did not withstand the searching investigation made by the Havana Yellow Fever Commission of 1879.

Nevertheless the mortality from this disease among the creole population of cities where it has established itself as an endemic malady is comparatively small, and by far the largest quota of its victims is drawn from among the strangers who visit the infected places, or residents who have recently located in them. Consult Camerer, C. B., 'Resumé of Etiological Factors Concerned in Yellow Fever' (in United States Naval Medical Bulletin, Washington, January 1915); and 'Yellow Fever' (Document No. 822 of the Sixty-first Congress, 3d Session, ib. 1911); Manson, Sir P., 'Tropical Diseases' (1907); Allbutt and Rolleston, 'System of Medicine'; Boyce, Sir R., 'Report on Yellow Fever in Honduras' (1906); 'Health and Administration in the West Indies' (1910); 'Bulletins of the United States Fever Institute'; *Annales* de l'Institut Pasteur (January 1906).

GEO. M. STERNBERG,
Sometime Surgeon-General, United States Army.

YELLOW-HAMMER, originally, in Great Britain, the common yellow bunting (*Emberiza citrinella*), which is yellow above, varied by dark-brown patches, the under parts being pure yellow, and the wing-feathers dusky black, with brown or yellow edges. The flanks are of a brownish hue. The nest is placed on the ground, and is composed of grasses, moss, roots, etc., and lined with hair. When fat, in the autumn, the birds are much in request for their flesh. They are regarded with superstitious dislike in some districts, and their eggs are broken by boys whenever they are discovered, a foolish saying being current that each egg contains a drop of "devil's blood." The birds are caught and fattened for the table in Italy. In the United States the term is misapplied to the goldenwinged woodpecker or highhole. See FLICKER.

YELLOW JACK, a quarantine flag displayed at naval hospitals and from vessels in times of epidemics (see QUARANTINE). Also a common name for yellow fever.

YELLOW-JACKET, any species of small American wasp, marked with black and yellow stripes. See WASP.

YELLOW-RATTLE, a scrophulariaceous plant *Rhianthus crista galli*, an annual herb with opposite, lanceolate, sessile leaves and terminal, one-sided, leafy-bracted spikes of yellow flowers. The corollas are two-lipped, with an arched upper lip, and three-lobed lower one. The capsule is orbicular and flat, with several round-winged seeds, which rattle about the pod when shaken, and have given rise to other descriptive names, such as rattle, rattle-box, penny-rattle, etc. In European fields it is very abundant and becomes a pest, since it is parasitic and attaches itself by suckers to the roots of living grasses.

YELLOW RIVER. See HWANG or HOANG-HO.

YELLOW-ROOT, either one of two ranunculaceous plants, one being known as the shrub yellow-root (*Xanthorrhiza apiifolia*). Its long roots and rootstock, leaves, bark and pith are bright yellow, and the root is extremely bitter and astringent, and is used as a tonic. This yellow-root grows in the southern United States and has pinnate leaves clustered at the top of a short stem, giving the plant a fern-like aspect. The foliage turns to gorgeous scarlet and orange in the autumn. The five-parted flowers are wine-colored. The other yellow-root (*Hydrastis canadensis*) is known also as golden-seal, or yellow puccoon; its root is a tonic drug. The plant has abundant reniform, palmately-lobed, basal leaves, and two cauline ones, the uppermost of these subtending the solitary, greenish-white flower. The puccoon is found in woods in the eastern United States and furnished the Indians with a favorite yellow dye.

YELLOW SEA, or HWANG-HAI, hwäng-hī', a gulf of the Pacific Ocean, extending between the northeast coast of China and the western coast of Chosen or Korea, northward to Manchuria; length about 620 miles; greatest breadth about 400 miles. North and northwest it terminates in the gulfs of Liao-tung and Pe-chi-li, the latter of which receives the waters of numerous large and important rivers. On the east coast are numerous groups of islets, part of them included in the Korean Archipelago. The Yellow Sea is very shallow, having in no part a greater depth than 300 feet, and is so named from the muddy lemon-yellow color of its waters near the land, caused by the large quantity of alluvium continually brought into it by the Hwang-ho or Yellow River, and the Yang-tse Kiang, which gradually tends to decrease its depth. Sand banks are numerous off the Chinese coast, and there are several islands off the Chosen coast.

YELLOW-WEED. See DYER'S ROCKET.

YELLOW-WOOD, a name applied to several timber trees and shrubs, including *Cladrastis lutea*. This is an uncommon leguminous tree, known in cultivation as the virgin American or Kentucky yellow-wood, and is indigenous to the United States from Ken-

tucky southwards. The yellow-wood attains to a height of 60 feet, with a trunk some two feet in diameter. It usually divides into two or three limbs not far from the ground, which ramify into slender and somewhat drooping branches, forming a broad, graceful head. In winter the smooth, silvery-gray bark of its main trunk and red-brown of its delicate sprays are very interesting. The limbs, however, are brittle and break easily. The foliage of the yellow-wood consists of light-colored, odd-pinnate leaves, turning to clear yellow in autumn; and fragrant panicles a foot or more long, of flowers, pea-like and milk-white, droop from the ends of the branches. The fruits are linear legumes. A yellow dye was made from the hard golden-tinted wood, which is used for fuel and occasionally for gun-stocks. The yellow-root (q.v.) (*Xanthorrhiza*); the Osage orange (*Toxylon pomiferum*), a favorite hedge plant; fustic, a dye-stuff yielded by the wood of *Chlorophora tinctoria*, a West Indian tree with oblong, taper-pointed leaves and an edible fruit; and *Schaefferia frutescens*, the valuable boxwood of the West Indies, are all known as yellow-woods. Australian yellow-woods are the *Acronychia laevis*, *Hovea longipes* and *Xanthostemon pachysperma;* and the white teak or Queensland yellow-wood (*Flindersia oxleyana*), also called light yellow-wood, is a tall, slender tree with many branches. Another tree called light yellow-wood is the *Rhus rhodanthema*, bearing large red flowers, and growing to 80 feet in height. It is native to Queensland, and yields a fine cabinet-wood, close-grained, capable of taking a fine polish, sound and durable. Natal yellow-wood is a tree of about the same height (*Podocarpus elongata*), with a close-grained wood which will not bear exposure out of doors, but is extensively used for furniture and interior house-building. The bastard yellow-wood of the same region is *P. pruinosa*, with a tough durable wood, also used in house building; still another species (*P. latifolia*), an evergreen about 80 feet high, having an aromatic wood, is the East Indian yellow-wood. This same name is given to the satin-wood (*Chloroxylon swietenia*). The prickly yellow-wood is *Zanthoxylum caribæum* (q.v.).

YELLOWBIRD, any of several familiar birds prevailingly yellow in plumage. In the United States the name belongs to two small garden-visitors. One is the goldfinch (q.v.), and the other often distinguished as "summer" yellow-bird is a warbler (*Dendroica æstiva*), common in summer throughout all the eastern United States and Canada. It is greenish yellow, brightest on the breast, where it is diversified by salmon-colored streaks. The song is a melodious trill, often heard among the roses and lilacs of the garden, where the bird is likely to fix its deep nest of hempen shreds in an upright fork. The eggs are pink, with reddish and purplish dots. This nest is one of the receptacles most often chosen by the cow-bird for its surreptitious egg; but the yellowbird frequently defeats the intruder's object, by building a new nest on top of the first one, burying the strange egg.

YELLOWHEAD, a yellow-headed blackbird. See BLACKBIRD.

YELLOWLEGS, a genus (*Totanus*) of birds of the family *Scolopacidæ*, large snipe-like species with cross-barred tail-feathers, well-marked gape, long, slender non-sensitive bill and greenish yellow legs, from which they take their common names of yellowlegs, greenshanks, etc., while, because of their constant noisy calling, they are known to gunners as tattlers or tell-tale snipe. The greater yellowlegs (*T. melanoleucus*) inhabits during some part of the year nearly the entire American continent and breeds chiefly north of the United States, in which it is well known as a coastwise migrant. It is 13 to 14 inches long, with a spread of wings of two feet. Above the color is a mixed dark ashy, varying with the age and season, below white streaked and barred with ashy black. Although chiefly a maritime bird, this species also migrates through the Mississippi Valley and is found about the lakes of the interior; and even along the coast it is fond of frequenting the fresh and brackish pools on the meadows, where it finds an abundance of food in the small fishes, mollusks, shrimps and crabs. It also eats worms, insects and the spawn of fishes, which it catches with great facility. During the migrations, which occur in April and from late August to October through the greater part of the United States, it is commonly seen in small parties of six or eight, often consorting with other species of tattlers, willets and godwits. The flight is swift and often elevated, and in alighting in pools in which they wade leg-deep they keep the wings raised until well settled. They are extremely alert and noisy and thus provoke the indignation of gunners. The nest is a grass-lined depression on the ground and the four, pyriform, greenish yellow, brown and gray blotched eggs measure upward of two inches in length. The lesser yellowlegs (*T. flavipes*) is in form and colors nearly an exact miniature of the last, but is only 10 or 11 inches long, with a spread of 20 inches. Its range and habits are similar to those of the larger species, but it is much commoner in the East, flies in larger flocks and is better known to shooters of shore-birds. The eggs are more variable, the ground-color being clay or buff, and the markings usually very bold and distinct. The European greenshank (q.v.) occasionally straggles to our shores and may be distinguished from *T. melanoleucus*, which it resembles in size, by the distinctly green color of the lower legs and feet. About a dozen related species are found in other parts of the world and the genus *Helodromas*, containing our solitary and green sandpipers, is closely allied. For methods of shooting see SANDPIPER.

YELLOWPLUSH PAPERS, The, a series of satirical papers by William M. Thackeray, which appeared in *Fraser's Magazine* in 1837–38, as 'The Yellowplush Memoirs,' and in book form in 1841 in the volume entitled 'Comic Tales and Sketches.'

YELLOWS, a disease of the peach (q.v.).

YELLOWSTONE, formerly **SUBLETTE**, a lake in the Yellowstone National Park (q.v.), at the northeast base of the Rocky Mountain range. It has an elevation of nearly 7,800 feet above sea-level. It is irregular in form, having extensions called West Arm, South Arm

and South-East Arm. The Yellowstone River flows through the lake, or as sometimes given, the lake is an expansion of the river. It is about 20 miles long and 15 miles wide.

YELLOWSTONE, a river which has its rise in the Shoshone Mountains, in the northwestern part of Wyoming, near lat. 44° N. It flows north, entering the Yellowstone National Park (q.v.) at the southeast corner, and passes through Yellowstone Lake, which is usually called an expansion of the river. From the lake the course is northeast, east, then northeast to the Missouri River, which it enters at Buford, on the boundary between Montana and North Dakota. The total length of the stream is about 1,000 miles. It is navigable for nearly 800 miles from its junction with the Missouri. The largest tributaries come from the south, and are Big Horn, Powder, Rosebud and Tongue rivers. The Grand Cañon of the Yellowstone (see YELLOWSTONE NATIONAL PARK) is one of the wonderful sights in a region of wonderful scenery.

YELLOWSTONE NATIONAL PARK, a government reservation in the northwestern part of Wyoming extending into Idaho and Montana, about 11 miles along the western boundary of the park and into Montana, about three miles along the northern boundary. In 1872 Congress set apart 3,575 square miles as "a public pleasure ground and a game preserve." In 1891 a tract of nearly 2,000 square miles was added to the east and south, making the total area 5,575 square miles. The mean altitude of the plateau portion is 7,800 feet. The "Continental Divide" passes through from the southeast to the northwest, and the "Rocky Mountain Divide" through the western part. Surrounding the park are numerous snow-clad mountains; on the south are the Shoshone Mountains, the Big Game and Teton ranges, on the east an extension of the Shoshone and on the southwest the Teton Range, the Big Bend Ridge on the west, and the Gallatin Range, part in the park, on the northwest. Some of the high peaks on the east are Index, 11,740 feet; Saddle Mountain, 10,676; Sunlight, 10,-678; Fortress Mount, 12,073 and Ishawooa Cone, 11,840. Within the limits of the park is the Absaroka Range on the eastern border, with numerous vast peaks; as Table, Humphrey, Schurz, Langford, Chittenden, Cathedral and Stevenson. In the northeast and inside the Absaroka Range, are the Specimen Ridge and the Mirror Plateau. In the northern and southern parts of the park are lofty elevations; Mount Holmes of the Gallatin Range and Bunsen Peak are among the highest. In the southern part of the park is Sheridan Mountain, 10,385 feet high, the highest point of the Red Mountains. This elevation was named in honor of Philip H. Sheridan. A large part of the peak is formed of porphyry of a purple-pink color. Mount Washburne in the north is noted as the peak from which large portions of the park may be seen. It was named in honor of H. D. Washburne, who explored this region in 1870. There are over 20 high peaks within the limits of the park. The central plateau is composed of vast quantities of lava in some places 2,000 feet deep. The Absaroka Range are made up of volcanic rocks, and nearly every part of this peculiar range shows the marks of having gone through a period of volcanic action. Sheridan in the south and Washburne in the north have been active volcanoes. Between Yellowstone and Shoshone lakes is a volcanic ridge about 225 feet in height. Six miles from the Grand Cañon of the Yellowstone is Sulphur Mountain, an immense mound of pure sulphur crystal with a number of steaming springs at its base.

Rivers and Lakes.— The "Continental Divide" marks the land-line of separation of the waters of the Atlantic and the Pacific. The headwaters of several large rivers are in the park; Yellowstone, Snake, Lewis, Madison and Shoshone are some of the streams which have headwaters here. The Yellowstone River (q.v.), Missouri River's longest tributary, rises or passes through Yellowstone Lake, for a stream which enters the lake on the opposite side is, also, called Yellowstone. The Grand Cañon of the Yellowstone is one of the wonders of this "Wonderland." Its walls on one side are 2,000 feet, and on the other side there is a gradual descent half way down of sliding cinnabar and other delicately tinted chalky formations, broken at intervals by towering pinnacles of mineral rock, which stand out in bold relief against the brilliant background. These pinnacles take on many fanstastic forms, inspiring the delusion that one is looking down upon the decaying splendors of antique architecture. From the base of these solemn sentinels, the descent to the water line is as abrupt as from surface to torrent on the opposite side. Far below winds the foaming current of white-crested wavelets spread out like a silvery band. Though the channel is 160 feet wide, it appears no larger than a brook. The whole volume of water breaks over a ledge, in the centre of which stands a huge black bowlder which divides the waters for a few feet, and again uniting they fall 370 feet. Showers of spray are sent up, which when touched by the sunlight look like innumerable and varied colored jewels. Another falls above the main waterfall is of considerable height and great beauty, and above are a series of cascades. The Grand Cañon is about 10 miles long. Tower Falls are so named on account of a mass of stone, about 100 feet from the verge of the precipice. The water below flows over a ledge about 150 feet high, and falls in solid sheets. Belcher River drains the southwestern part of the park. Madison, another tributary of the Missouri, has its source at the confluence of the Gibbon and Fire Hole rivers in the western part. In the northwest is the Gardiner River, a branch of the Yellowstone. Yellowstone Lake (q.v.), the largest body of water in the park, is said to have 300 miles of shore line, but it never has been fully explored. It certainly is the gem of the lakes, set as it is in a series of mountain peaks, with pine-clad slopes and snow-crowned summits. The monotony of its crested waves is broken by a verdure-clad island, Frank Island, giving it the appearance in summer of an emerald in a setting of brilliants. Shoshone Lake, next in size, is west and Heart Lake is south of Yellowstone. North of Yellowstone is a group of small lakes, the largest of which is White Lake

Terraces built by the overflow of Geysers (Mammoth Hot Springs)

mountains, the marshy bottoms, and the steep rocky slopes. The black pine is the most common; in some places there are forests composed almost wholly of black pine (*Pinus Murrayana*), which here do not attain any great size. The balsam is found on the high plateaus, and varieties of fir and spruce are abundant. Forests exist at an elevation of 9,700 feet. Grasses are found on the plateaus and the herbaceous vegetation found in the Rocky Mountains. Above the timber line the vegetation is about as in other parts of the summits of the Rocky Mountains. The gentian is one of the favorite flowers of this section. Near the hot springs the vegetation is affected by the overflow and other causes; it is stunted and in some places has been killed entirely. Petrified trees are found in the northwest.

Fauna.— The wild animals of the park are protected by government laws and as a consequence are becoming more numerous than in other parts of the Rocky Mountains. A herd of buffalo is one of the features of the place. Another wild herd numbering about 50 individuals is glimpsed occasionally. The animals found here are deer, antelopes, elk, mountain lions (pumas), beaver, black and brown bears and moose. Sheep are found on the high lands. Grouse is found in some parts, but there are not many birds in this region. Fish abound; trout are in many streams.

Government and Improvements.— Since 1872 the government has had entire control of a portion of what is now the Yellowstone National Park and later took control of additional lands, and now has entire jurisdiction over all the park. The administrative officials are under the Secretary of the Interior. An army officer is the superintendent in direct charge and he has as his aids a detachment of Federal troops. On 1 July 1900 the Secretary of the Interior gave to the public the following instructions:

The following rules and regulations for the government of the Yellowstone National Park are hereby established and made public pursuant to authority conferred by section 2,475, Revised Statutes, United States, and the act of Congress approved 7 May 1894:

(1) It is forbidden to remove or injure the sediments or incrustations around the geysers, hot springs or steam vents; or to deface the same by written inscription or otherwise; or to throw any substance into the springs or geyser vents; or to injure or disturb, in any manner, or to carry off any of the mineral deposits, specimens, natural curiosities or wonders within the park.

(2) It is forbidden to ride or drive on any of the geyser or hot spring formations or to turn loose stock to graze in their vicinity.

(3) It is forbidden to cut or injure any growing timber. Camping parties will be allowed to use dead or fallen timber for fuel.

(4) Fires shall be lighted only when necessary and completely extinguished when no longer required. The utmost care should be exercised at all times to avoid setting fire to the timber and grass and any one failing to comply therewith shall be punished as prescribed by law.

(5) Hunting or killing, wounding or capturing of any bird or wild animal, except dangerous animals, when necessary to prevent them from destroying life or inflicting an injury, is prohibited. The outfits, including guns, traps, teams, horses or means of transportation used by persons engaged in hunting, killing, trapping, ensnaring or capturing such birds or wild animals, or in possession of game killed in the park under other circumstances than prescribed above, will be forfeited to the United States, except in cases where it is shown by satisfactory evidence that the outfit is not the property of the person or persons violating this regulation, and the actual owner thereof was not a party to such violation. Firearms will only be permitted in the park on written permission from the superintendent thereof. On arrival at the first station of the park guard, parties having firearms will turn them over to the sergeant in charge of the station, taking his receipt for them. They will be returned to the owners on leaving the park.

(6) Fishing with nets, seines, traps or by the use of drugs or explosives, or in any other way than with hook and line, is prohibited. Fishing for the purposes of merchandise or profit is forbidden by law. Fishing may be prohibited by order of the superintendent of the park in any of the waters of the park or limited therein to any specified season of the year, till otherwise ordered by the Secretary of the Interior.

(7) No person will be permitted to reside permanently or to engage in any business in the park without permission, in writing, from the Department of the Interior. The superintendent may grant authority to competent persons to act as guides and revoke the same in his discretion and no pack trains shall be allowed in the park unless in charge of a duly registered guide.

(8) The herding or grazing of loose stock or cattle of any kind within the park, as well as the driving of such stock or cattle over the roads of the park, is strictly forbidden, except in such cases where authority therefor is granted by the Secretary of the Interior.

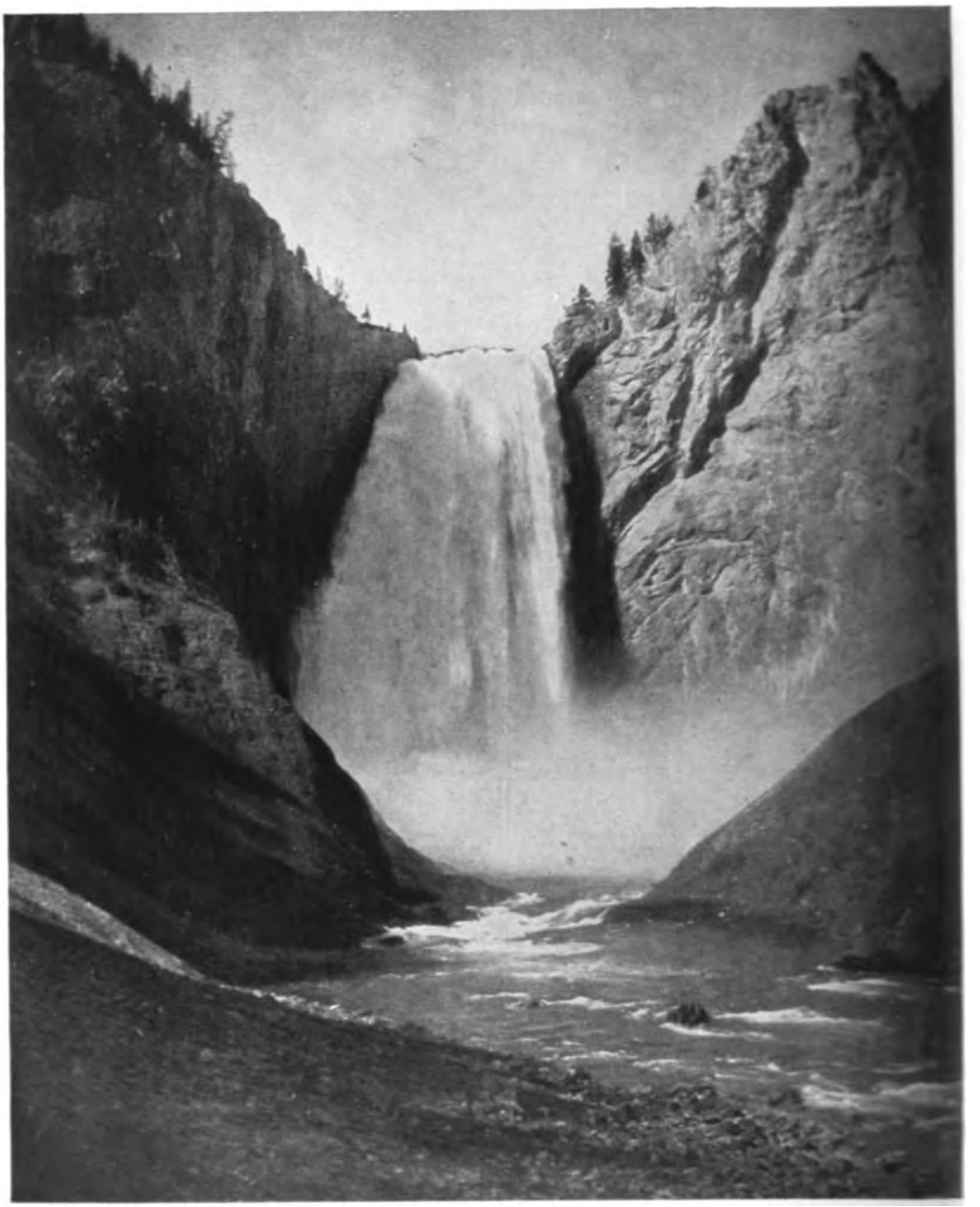
(9) No drinking saloon or bar room will be permitted within the limits of the park.

(10) Private notices or advertisements shall not be posted or displayed within the park, except such as may be necessary for the convenience and guidance of the public, on buildings on leased ground.

(11) Persons who render themselves obnoxious by disorderly conduct or bad behavior, or who violate any of the foregoing rules, may be summarily removed from the park, and will not be allowed to return without permission, in writing, from the Secretary of the Interior or the superintendent of the park.

Any person who violates any of the foregoing regulations will be deemed guilty of a misdemeanor and be subjected to a fine, as provided by the act of Congress approved 7 May 1894, "to protect the birds and animals in Yellowstone National Park and to punish crimes in said park, and for other purposes," of not more than $1,000, or imprisonment not exceeding two years, or both, and be adjudged to pay all costs of the proceedings.

Prior to 1870 little was known about the region now included in the park. In 1870 H. D. Washburne, surveyor-general of Montana, and G. C. Doane, an army officer, explored this region and gave the first report of the wonderful springs and geysers. In 1872 the government sent Ferdinand V. Hayden, United States geologist, and a number of assistants, to explore this



Bridal-veil Fall

region. The place is visited annually by thousands of tourists and accounts of this wonderful park have been published in all languages. The park is reached by the Chicago, Burlington and Quincy Railroad, which operates to Cody, Wyo., thence by stage to the eastern part of the park. The Northern Pacific takes the traveler to Gardiner, Mont., to the north of the Park, and the Oregon Short Line Railroad reaches the western border at Yellowstone, Mont. Consult *Wonderland*, an annual published by the Northern Pacific Railroad; Chittenden, 'Yellowstone National Park,' with bibliography (Chicago 1915); Hague, 'Geological History of Yellowstone National Park' (Department of the Interior, Washington 1912); Weed, 'Geysers' (ib. 1912); Knowlton, 'Fossil Forests of the Yellowstone National Park' (ib. 1912); Richardson, 'Wonders of Yellowstone'; United States Geological Survey; 'General Information regarding Yellowstone National Park' (annually, Department of the Interior, Washington).

YELLOWTAIL, or BLANQUILLO, a trachinoid fish (*Caulolatilus princeps*) of the coast of Southern California and southward, allied to the Atlantic tilefish (q.v.), which reaches a length of 40 inches. It abounds about rocky parts of the coasts, is good food and interesting as a gamefish. Several other fishes in various parts of the world are called yellowtails, in reference to the yellow or orange color of the tail fin.

YELLOWTHROAT. See MARYLAND YELLOWTHROAT.

YEMASSEE, The, 'The Yemassee, a Romance of Carolina' (1835), one of the earliest and on the whole perhaps the best of the novels of William Gilmore Simms, deals with the little-remembered Yemassee War of 1715 in a manner still effective after all the intervening changes of fashion in romance. Much of the material indeed recalls the older romantic commonplaces: the aspen-like heroine Bess Matthews; Gabriel Harrison, irresistible in love and war, who turns out to be the Palatine Charles Craven, capriciously masquerading; bloody, swaggering pirates; Indians as cruel as eloquent; and the accustomed paraphernalia of raids and sieges and powwows and heroics. But along with these are such solid realities as Hector, the negro slave, obviously studied from life as Simms knew it, and Mrs. Grayson, the settler's wife, too hard and strong to be a mere heroine. Above either romantic common-places or normal realities stands one episode so powerfully conceived and handled that it ought to have a secure place in the world of the imagination — the episode in which Matiwan, devoted Indian mother, kills her son Occonestoga in order that he may not suffer the disgrace which his tribe has already decreed for him. The book is packed with varied adventure, breathlessly recounted in a style often turgid and verbose but capable at times of dramatic economy and intensity. It is accurate as to topography and is steeped in that traditionary lore of South Carolina upon which Simms drew for his happiest successes.

CARL VAN DOREN.

YEMASSEE WAR. See COLONIAL WARS IN AMERICA.

YEMBO-EL-BAHR, yĕm'bō-ĕl-bär, Arabia. See YAMBO.

YEMEN, Arabia, a division occupying the southwest angle of the peninsula, and known both to the ancients and moderns as Arabia Felix (Arabia the Happy), from a mistranslation by Ptolemy of *Yemen*, which does not signify happy but the land lying to the right of Mecca. Yemen, in the widest sense, is bounded on the west by the Red Sea, on the south by the Gulf of Aden, on the north by Hejaz and Nejd, and on the east by Hadramaut. It comprises two regions physically distinct: the Tehâma or Lowland, lying between a chain of mountains which extends throughout the country and the west coast; and an elevated mountainous tract to the eastward of the former. The Tehâma varies in breadth from 10 to 30 miles, and is a barren desert wherever it is not irrigated by the mountain streams. The mountains rise abruptly from the desert plain, enclosing valleys of great luxuriance. The table-land in the interior has an estimated elevation of 4,000 feet, and some of its mountain groups, as Saber, south of Taes, attain a height of 7,000 to 8,000 feet. The loftiest of these mountains are covered with forest to the summit, and the table-land abundantly furnishes coffee, dates, senna, tobacco and other productions of rather a warm temperate than a torrid region. Its approximate area is 77,200 square miles. Yemen, taken collectively, still bears unmistakable traces of its ancient superiority in wealth and civilization. In its numerous well-built towns are many rich merchants, while in the well-populated rural districts the peasantry are generally in easy circumstances. There are two great schools or universities, one at Zebid for Sunnites, and another at Damar for the Zeidé. The principal towns are Sana, the capital, Mocha, and Aden, which last is now in the possession of the British. Pop. 750,000. See EUROPEAN WAR; TURKEY; HEJAZ.

YEN (Chinese, *Yuen*, a round thing), a Japanese coin issued in 5, 10, and 20 yen pieces (gold). A gold yen is equal to 49.8 cents in United States gold.

YENIKALÉ, yĕn-ē-kä'lā, Strait of, called also **STRAIT OF KAFFA** and **STRAIT OF KERTCH,** Russia, connects the Black Sea with the Sea of Azov; it is about 25 miles long and from two and one-half to 20 miles broad, but in some places is so shallow as to leave a channel of little more than two fathoms deep. The channel has been dredged and has now a depth of 24 feet.

YENISEI, yĕn-ē-sā'ē, Siberia, the longest river of the region, formed by numerous streams from the mountain ranges bordering China and Russia. It has at first a circuitous, and then an almost direct northward course of about 3,260 miles, finally reaching the Arctic Ocean through the long estuary, and gulf of the same name. Its breadth varies from 3,000 feet to 14 miles in its estuary which is 140 miles long, and its depth varies from 11 to 90 feet. The area of its basin is estimated at about 1,000,000 square miles. A canal connects it with the Ob. The principal towns on its banks are Minusinsk, Krasnoiarsk, Yeniseisk and Turukansk; it is navigable to the last-named town for large vessels. The waters of the

Yenisei are clear and rich in fish. They are navigated by paddle steamers, drawing barges, and by a number of five or six cornered flat-bottomed boxes which convey flour down stream, and are broken up at their destinations. The Yenisei receives from the right the Upper Tunguska or Angara (the outlet of Lake Baikal), the Irkut, Middle Tunguska and Lower Tunguska. Nordenskjöld's voyage in the summer of 1875 from Tromsö to the mouth of the Yenisei opened up a trade by sea with northern Siberia, in which a number of vessels are now engaged, finding six weeks in summer when the passage to and from the Yenisei can be made with little difficulty. The Yenisei is exceeded in length by the Amazon, the Nile and the Mississippi-Missouri. It is obstructed by ice for almost six months at Turukhausk and for about seven months at Krasnoyarsk, at which point the river is crossed by the Trans-Siberian Railway.

YENISEISK, yĕn-ē-sā'ĭk, Siberia, (1) a town in the government of the same name on the left bank of the Yenisei, 200 miles north of Krasnoyarsk. It has several churches, a monastery, museum of natural history and archæology and a public library. It is in the northern gold-mining region, has a custom-house, an extensive trade, particularly in furs, and an annual fair. Pop. about 13,000. (2) A province in the government of Irkutsk, bordering on the Arctic Ocean, bounded east by Yakutsk and Irkutsk, south by Mongolia, and west by Tomsk; area, 987,186 square miles; capital, Krasnoyarsk. The south part of the province is occupied with the Altai Hills and their offsets. In the Yenisei valley considerable tracts are under tillage, but north of the town of Yeniseisk this is succeeded first by pasturage, then by stretches ever more and more desolate, to the frozen tundras. The chief river is the Yenisei. Smaller streams are the Taimyr, Katanga and Anabar, which, like the Yenisei, form great gulfs at their mouths. The gold washings of Yeniseisk occupy 12,000 to 15,000 men and several thousand horses. Of the native tribes, who live by hunting, fishing, and trade in fur, the chief are Samoyedes and Tungus. The mean annual temperature ranges from 8° to 31° F. In recent years flax-growing has increased. There are extensive and valuable forests, in which much damage is wrought annually by fires. Pop. 970,800. Consult Martianor, N., 'Materials for a Flora of the Minusinsk Region' (in *Trudy* of the Kazan Society of Naturalists, Vol. XI, 3, 1882 and Radlov, W., 'Aus Sibirien' (2 vols., Leipzig 1880).

YEO, yō, Sir **James Lucas,** English naval officer: b. Southampton, Hampshire, 1782; d. at sea, 1818. Entering the navy at 11 he was present at the siege of Genoa in 1800, and while in command of a force of English and Portuguese captured Cayenne, French Guiana. In 1813 he became commander-in-chief of the English naval force of the Great Lakes and soon came into conflict with the American ships of war there. An engagement occurred at York Bay, 28 May 1813, in which Yeo received a severe drubbing and was blockaded afterward at Kingston by Chauncey. In the following year Yeo was made commander-in-chief of the English fleet on the west coast of Africa.

YEOMAN, yō'măn, a term of early English origin formerly applied to a feudal attendant or servant, but in the 15th century and subsequently denoting a small freeholder below the rank of gentleman. The term yeoman was given also to the 40 shillings freeholder, and commonly to any small farmer or countryman above the grade of laborer. The term is also familiar in the titles of functionaries in royal households, such as yeoman usher of the black rod, yeoman of the robes, etc., and other appendages to worn-out and useless royalty.

YEOMAN OF THE GUARD, in England, a corps of veteran soldiers of stately presence, employed on state occasions in conjunction with the gentlemen-at-arms as the bodyguard of the sovereign. The yeomen were constituted a corps in 1485 by King Henry VII, and they still wear the costumes of that period. The officers of the corps are a captain, ordinarily a peer, a lieutenant, and an ensign — all old army officers. There are also a "Clerk of the Cheque" and four "Exons," besides non-commissioned officers (messengers, sergeant-majors, yeoman bedgoers, yeoman bed-hangers), and 100 privates. The Beef-Eaters or Warders of the Tower are, contrary to common belief, an entirely different corps, but since the reign of Edward VI have been privileged to wear the yeoman's uniform, without the shoulder belt. It is to be hoped that the democratization of peoples, proceeding apace in this 20th century, will soon reach and wipe out these and similar satellites as well as those before whom they bend the knee. See BEEF-EATERS.

YEOMANRY, a force of volunteer cavalry first enrolled in Great Britain during the wars of the French Revolution, and consisting to a great extent of country gentlemen and farmers possessing their own horses and requisite equipment. They were liable to be called out in aid of the civil power in case of riot at any time; in case of actual invasion, or the appearance of an enemy on the coast or during a rebellion, they might be assembled for actual service; they were then subject to the Mutiny Act and Articles of War, and might be called upon to serve in any part of Great Britain. During permanent service they received cavalry pay and an allowance for forage. For their services during the Boer War, 1899–1902, they received the title of Imperial Yeomanry. Colonial Yeomanry have been enlisted for the defense of the British colonies. The Imperial Yeomanry became part of the territorial forces in 1907. See GREAT BRITAIN — THE BRITISH ARMY.

YERBA MATÉ. See MATÉ.

YERKES, yĕr'kēz, **Charles Tyson,** American capitalist: b. Philadelphia, Pa., 25 June 1837; d. New York, 29 Dec. 1905. He received a secondary education in Philadelphia at the Central High School, was for a time in the flour and grain business, in 1859 became a stock-broker, and in 1861–86 was in banking, first in Philadelphia, and from 1881 in Chicago. In 1871 he was obliged to make an assignment, but by fortunate investments he soon financially re-established himself, and became prominently connected with the Philadelphia street-railways system. At this time he refused to give preference to the city of Philadelphia for bonds so on its account. He was thereupon indicted for

Florida, a bushy tree (*T. floridana*) with many stout spreading branches and a short trunk. It rarely exceeds 30 feet in height. A Japanese species (*T. cuspidata*), with a bright red bark, is now being introduced to cultivation, and is of bushy habit, and more hardy and successful than the European yew. This is a great favorite with the Japanese, who clip it into fantastic shapes. The most familiar yew in Canada and the eastern United States is *T. canadensis*, a very low, shrubby species with decumbent branches radiating in every direction and forming thickets hard for a man to travel through, but a first-rate cover for grouse. It grows in moist lands under the shade of trees, and is readily recognized by its dark foliage and the glowing, crimson, oblong, cup-like fruits.

YEZD, *yĕzd*, or **YAZD**, Persia, (1) A town, capital of a province of the same name, in an oasis in a sandy plain, 190 miles southeast of Isaphan. It is about five miles in circuit; consists of an old town, enclosed by a wall and ditch, defended by a citadel, and entered by four gates; and of a larger new town or suburb, which has risen up in a straggling population. Within the citadel are a palace, the principal mosque, several other public buildings, and the residences of the chief men of the district. The bazaars are spacious and well supplied, particularly with the staple manufactures of the town itself, consisting of silk stuffs, velvets, cottons, coarse woolens called *numuds*, loaf-sugar, and sweetmeats. The position of Yezdz, on the edge of a desert, at the junction of the principal caravan routes, makes it an important commercial entrepôt for the surrounding countries. Silk, felt goods, opium and sugar are the chief items of trade. Pop. about 45,000, of which about a tenth are Zoroastrians or fire-worshippers. (2) The province has an area of about 20,000 square miles, and its population is estimated at 100,000.

YEZEEDEES, or **YEZIDIS**, *yĕz'ē-dēz*. See RELIGIOUS SECTS.

YEZO, *yā'zō*, **EZO**, or **HOKKAIDO**, *hōk-kī'dō*, Japan, the northernmost of the four main islands of the empire, separated from Hondo on the south by Tsugaru Strait, from Sakhalin on the north by La Pérouse Strait, while Yezo Strait divides it from Kunashiri, the southernmost of the Kurile Islands; area, including dependent islands, 30,143 square miles. The capital is Sapporo; Hakodate, Mororan, and Otaru are other large towns and open ports. Yezo is curiously like a skate-fish in shape. The centre of the island is but little known, though it has been crossed twice or thrice by Japanese and European explorers. It is traversed by chains of mountains, the principal summits being Tokachi-dake, 8,200 feet; Shribetsi-yama, 7,874 feet; Ishikari-dake, 7,710 feet; Sapporo-dake, 6,500 feet; and Komaga-dake, 3,830 feet. Much of the island is volcanic, especially in the east. The chief rivers are the Ishikari and Tesshio, flowing into the Sea of Japan; and the Tokachi, flowing into the Pacific Ocean. The chief bays are Volcano Bay, in the south; Ishikari Bay, in the west; Shari and Walfish bays, in the northeast. Yezo has a rigorous climate, being for six months of the year under snow and ice, two feet in the south to eight feet in the north. The original inhabitants of Yezo were probably pit dwellers, of whom distinct traces have been found at Sapporo, Nemuro, and elsewhere. After these came Ainos or Ainus, whose principal settlement is at Piratori, 50 miles east of Mororan. The bear festival in September is the great event of their year. The Ainos number 15,000, a population either stationary or decreasing; they are harmless, lazy and drunken, and live mostly near the mouths of the rivers. The southern corner of the island was wrested from them in the 16th century, and Matsumae, now Fukuyama, in the extreme southwest, became in the next century the headquarters of Japanese rule. From 1600 to 1868 the southwestern portion of the island was in possession of a Daimio named Matsumai, and the Shogun was in possession of Hakodate. At the restoration in 1868 the supporters of the Tokugawa government made a last stand here, and were finally defeated at Hakodate. In 1871 the Japanese began active colonization, fearing aggression on the part of Russia, and a new department — the Colonization Department — was established to further these projects and much development work was done under the supervision of foreigners. This department, however, was abolished in 1881 and the country divided into prefectures, though its inhabitants do not as yet enjoy any electoral privileges. The fauna and flora of Yezo differ materially from those of the main island, the bear being a different species, resembling the grizzly. There are no monkeys; a species of grouse is found. The deer, once very plentiful, are now comparatively scarce. The Yezo pony, originally from Nambu on the main island, is hardy, and foreign blood has been introduced, promising good results. The forests furnish valuable timber. Coal, petroleum and gold are found and worked to some extent. The official name Hokkaido, "Circuit of the Northern Sea," was bestowed in 1870, when it was brought under a special colonization department. An agricultural mission from the United States assisted in founding model farms, laying out roads and building bridges. The capital was changed from Matsumai to Sapporo, which was provided with a railroad to Otarunai, its port, and to Poronai, the great coal district inland. An agricultural college, breweries, canning factories, beet-root sugar factories, etc., were established. The coal mines are worked by convict labor. A system of military settlements in late years was put into force, partly with the view of furnishing a militia against possible invasion from Russia, which at that time was supposed to covet the fine harbors of Yezo. The sheltered harbor of Mororan, on Volcano Bay, is now a naval harbor, to which a railway from Poronai mines has been built. The principal products of Yezo are coal, seaweed, sulphur, fish, the catches of salmon on the river Ishikari being sometimes enormous. Kerosene, beer, glass, and other articles are manufactured, and internal communication is facilitated by a system of railways, either constructed or projected, joining all the important coast and interior towns. Pop. (including the Kurile Islands), 1,459,424. See JAPAN.

YGGDRASILL, or **YGDRASIL**, *ig'drā-sĭl*, in Scandinavian mythology, the giant ash tree overspreading the whole world and reaching above the heavens. It binds together earth, heaven and hell, and its roots stretch out to the Asa or Æsir gods in heaven, to the frost giants, and to the under world. A marvelous fountain

springs up under each of these three great roots and in the tree, whose boughs drip continually with honey, dwell an eagle and the squirrel Ratatöskr. At its roots the serpent Nithöggr gnaws, and between the serpent and the eagle runs the squirrel constantly endeavoring to provoke the two to strife. Certain writers detect in this myth a distortion of the story of the Cross, but the translator of Grimm says, "it were a far likelier theory, that floating heathen traditions of the world tree, soon after the conversion in Germany, France or England, attached themselves to an object of Christian faith just as heathen temples and holy places were converted into Christian ones."

YIDDISH LANGUAGE. Yiddish, the Englishized form of German *Jüdisch* (Jewish), is one of the names applied to the various German dialects spoken by the Jews of German origin in the diaspora, in Russia, Rumania, Poland and Austria-Hungary, and in England, America, and South Africa, whither Russian and Rumanian Jews have been emigrating in the last 30 years. In Russia it is known under the name of *Jargon*, while philologically it is generally spoken of as *Judeo-German*.

No literary documents of any consequence bear upon the condition of this group of dialects previous to the 16th century, and even in the printed works up to a hundred years ago the literary norm seems to have attempted an approach to the literary German, though even then the deviation was considerable and fairly uniform. In the last century the spoken dialects have been asserting themselves in the literary productions, so that the uniformity no longer exists, each author writing in the variation familiar to him from childhood.

It seems that at first, in the Middle Ages, the German Jews employed the language of their Christian neighborhood without any change whatever; in their intercommunication with their coreligionists they transcribed this German with Hebrew characters and introduced, Germanizing them, such Hebrew words as were necessitated by the observances of the Mosaic faith. When the German Jews, in the 14th and 15th centuries, settled in Poland, they were cut off from the rest of the German nation, and so their native dialects perpetuated themselves in the form in which they were brought from their homes. They were subjected, however, to the double influence of their Slavic neighborhood and the language of the Bible and the Talmud, to which the Jews devoted themselves with unwonted zeal. In vocabulary, the Yiddish is predominantly German, less than one-third having been derived from Slavic, Rumanian and Hebrew sources. In pronunciation, the influence of Russian and Polish is doubtful or less transparent, while Hebrew, instead of affecting it, was itself affected by the current pronunciation of Yiddish. In syntax and idiom, both the Slavic and the Hebrew have considerably modified the native German, without, however, obliterating the original German basis. At present, three chief varieties may be distinguished in the Yiddish of Russia, the Lithuanian, the Polish, and the Southern; the dialects in Austria and Hungary are more nearly related to the two latter, while the Rumanian is more akin to the Polish variety. In America all three varieties may be heard, but they are strongly influenced in vocabulary by the English, and in the periodic press the Lithuanian variety, affected by literary German, seems to supersede all other dialects. The three varieties correspond to their places of origin in Germany, the Lithuanian issuing from a Middle-German home, the other two from various Upper-German localities. The precise *provenience* has not yet been ascertained, as the linguistic study of Yiddish has heretofore been greatly neglected.

The chief differences between Yiddish and the modern German are these: Phonetically, Yiddish represents a mediæval stage of German when, for example, *i* and *ei* were still carefully distinguished, while *u* before a nasal had not yet changed into *o*; on the other hand, the consonantism, especially the treatment of *pf*, seems to correspond to a later stage. The vocabulary of Yiddish is rich in words only sporadically found in German dialects and common to the Middle-High-German literary language. The words from the Hebrew are phonetically treated as Yiddish words, while those from Russian and Polish, to some extent, underwent the changes due to the peculiarity of Yiddish, and present some interesting data to the Slavic scholar. In grammar, Yiddish has developed certain peculiarities which are common to various German dialects. Most prominent are the disappearance of final unaccented *e*, of the genitive case in the declension of the noun, of the imperfect tense in the verb. In syntactic structure, Yiddish resembles English, rather than German, and in English-speaking countries naturally adopts some of the English idioms. But, on the whole, Yiddish is an important group of German dialects, well worthy of a thorough study by the Germanic philologist.

Bibliography.— There are no good grammars of Yiddish; for dictionaries one may use the Russo-Yiddish ones by Lilschiz and Dreisin, and the Yiddish-English and English-Yiddish ones by A. Harkavy. To the student of philology the following works and articles will prove of value: Landau, A., 'Bibliographie des Judisch-deutschen,' in *Deutsche Mundarten, Zeitschrift für Bearbeitung des mundartlichen Materials* (herausgegeben von Dr. Johann Willibald Nagl, Vienna 1896, Heft II, pp. 126–132); Landau, A., 'Das Deminutivum der galizisch-jüdischen Mundart, Ein Kapitel aus der jüdischen Grammatik' (ib., Vol. I, pp. 46–58); Cerzon, Jak. 'Die jüdisch-deutsche Sprache, Eine grammatisch-lexikalische Untersuchung ihres deutschen Grundbestandes' (Frankfurt a. M. 1902); Loewe, Richard, review of Gerzon's work, in *Anzeiger für indogermanische Sprach- und Altertums-Kunde* (Vol. XVI, 1904, pp. 43–50); Sainéan, L., 'Essai sur le judéo-allemand et spécialement sur le dialecte parlé en Valachie' ('*Extraits des Mémoires de la Société de Linguistique de Paris*'), (Vol. XII, première partie, Paris 1902); Landau, A., review of Gerzon's and Sainéan's works, in *Zeitschrift für deutsche Philologie* (Vol. XXXVI, 1904); and a valuable bibliography of scattered articles by Fränkel, L., in *Litteraturblatt für germanische und romanische Philologie* (Vol. XXII, pp. 386–391).

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YING-TSE, ying'tsĕ', a noted sea port in Manchuria. See NIU-CHUANG.

YLANG-YLANG, Attar of, a perfume fully as exquisite and as precious as the much-praised attar of roses. The ylang-ylang tree attains a height of 60 feet and has drooping, greenish-yellow flowers three inches long and extraordinarily fragrant. It is common in the Philippines. It is found chiefly in the well-populated provinces and islands, and the natives say that it thrives best near the habitations of man. The propagation in plantations, by seed or cuttings, about 20 feet apart, each way (108 trees to the acre), is easy, and the growth rapid in almost any soil. The first flowers appear in the third year, the eighth yielding as high as 100 pounds, the bloom occurring every month. The greatest yield is from July to December. The process of converting the long, greenish yellow, fragrant petals of the flower into essence is by the simplest form of distillation, using merely water and the choicest flowers. No chemicals of any kind are required.

YMIR, ē'mir, in Scandinavian mythology, the personification of Chaos, or the first created being, produced by the antagonism of heat and cold in Ginnungagap, the primeval abyss. Slain by Odin and thrown into Ginnungagap, his flesh was transformed into land, his bones becoming the mountains, his blood the rivers and lakes, his hair the forests, while his skull constituted the heavens, and his brains the clouds.

YOAKUM, Tex., town in De Witt and Lavaca counties, 80 miles east of San Antonio, and on the San Antonio and Aransas Pass Railroad. It is situated in an agricultural region, has railroad shops, a canning industry, creamery, a turkey abattoir, bottling works and manufactures of ice, flour and corn meal. Pop. about 4,657.

YOGA, yō'gā (meaning, in Sanskrit, concentration) one of the six schools or systems of Brahmanical philosophy, that of Patanjali, the essence of which is meditation. It believes in a primordial soul which has had existence from an earlier period than primeval matter, and holds that from the two arose the spirit of life (Mahanatma). Theoretically at least, its devotees can acquire even in this world entire command over elementary matter by certain ascetic practices, such as long continued suppression of the respiration, inhaling and exhaling the breath in a particular manner, sitting in 84 attitudes, fixing the eyes on the tip of the nose, and endeavoring, by force of mental abstraction, to unite themselves with the vital spirit which pervades all nature and is identical with Siva. When this mystic union is effected, the Yoga can make himself lighter than the lightest, or heavier than the heaviest substance, or as small or as large as he pleases; he can traverse all space, can become invisible, can equally know the past, the present and the future, and can animate any dead body by transferring to it his own spirit. It is claimed that the whole doctrine of the Yoga works toward the establishment of the Supreme Being; and that it claims that it possesses the means by which the soul may become finally united with the Creator from whose hand it came. The system is said to have been founded by Patanjali (q.v.), who claimed that eight distinct stages were necessary in the development of the soul before it reached that condition in which it was exempt from further transmigrations. These stages are yama (self-control), niyama (religious observances), prānāyama (breath regulation), pratyāhāra (restraint of senses), dhāranā (making the mind firm), dhyām (meditation), samādhi (deep contemplation). These correspond generally to the general characteristics of the system given above. Each stage must follow in its order and is dependent upon the attainment of all the stages that precede it; and the great object of the whole is to reach the final stage. Owing to the difficulty of the attainment of all these successive stages of perfection the adherents of the Yoga believe that it is very rarely that any one reaches them all in this life and that consequently most persons must pass through several births and existences in the attainment of the final goal. In the course of this progress, however, one is believed to acquire wonderful powers. He is enabled to make himself light or heavy, at will, to acquire a knowledge of the past and the future, to understand the language of all animals, to penetrate the thoughts of others; to remember all that has happened to him in supposed former stages of existence; and even to transcend all this and to attain to a knowledge of what is going on or has taken place in the stars and in all other worlds. To these powers the believer in the Yoga adds that of the ability to make himself infinitely small or large beyond imagination. These are accompanied by wonderful powers of body and will and the nicest discrimination in all things, together with the ability to transport oneself anywhere suddenly at will. These wonderful powers are gradually acquired and finally result in the complete separation of the soul from the corporal body in the ultimate triumph of the former.

The Yoga system has always had a stronghold on its followers principally because of the great powers which it claims to bestow upon its devotees, and on account of the fears of those living upon earth who are believed to have attained to these powers.

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YOKE, a piece of timber, hollowed or made curving near each end, and fitted with bows for receiving the necks of oxen, by which means two are connected for hauling loads, plows, etc. A frame of wood fitted to a person's shoulders for carrying a pail, etc., suspended on each side. The ancients regarded the yoke as a symbol of slavery, and it was

customary for vanquished armies to pass under a yoke, formed like a gallows, of two upright spears, and a third fixed transversely at top. The word *subjugate* (*sub*, under, and *jugum*, yoke) is a reminder of this custom.

YOKKAICHI, yŏ-kā-ē-chē, Japan, a modern sea-port, with spacious harbor, on the Tokaido and fronting the bay of Ise, 23 miles from Nagoya. It is connected by railway and by steamship service with most of the ports and foreign countries. Its import trade amounts to over $5,000,000 yearly, with exports of tea, textiles and porcelain. Its manufactures are faience, paper, and striped cotton cloth. It has modern edifices, including Christian churches, and many tall chimneys, a modern feature. The healing hot springs of Yunoyama, 12 miles distant, are famous. Pop. about 33,812.

YOKOHAMA, yō-kō-hā'mā, Japan, the chief seaport of the empire, on the Bay of Tokio, about 17 miles southwest of Tokio, of which it is the port. Yokohama is of modern growth, its rise being due to the opening of Japan to foreign commerce and to the establishment here of foreign merchants, consuls, etc., after the adjacent Kanagawa was declared a treaty-port. The dwelling-houses and warehouses of the foreign residents are of a superior character, and are built on the bluff facing the bay. The commercial buildings occupy the east of the town, the western part being the Japanese town, and the centre being occupied by the prefecture, custom-house, post-office and other official buildings. The bay is very beautiful, and, though only an open roadstead, affords a good and commodious anchorage, not only to extensive mercantile shipping, but also to the naval squadrons of other powers. Work on a large harbor was carried out in 1889–96, the main object of which was to prevent the gradual silting up of the anchorage; it is enclosed by two breakwaters one and one-quarter miles long, and an iron pier, 1,900 feet long, connected with the railway to the capital, 17 miles off. Yokohama is a centre for tourists visiting Japan. The imports into Yokohama are valued at approximately $120,000,000, mainly sugar, metals and metal manufactures, cotton manufactures, kerosene, raw cotton and woolens; the exports at $160,000,000, mainly raw and manufactured silk, copper, tea, fish, cotton goods, fish-oil and paper. The number of vessels entered annually is about 3,600 with a tonnage of about 11,500,000, mainly British, Japanese, Russian, American and French. Pop. 428,663.

YOKOI HEISHIRO, yō-kŏy' hāy'shē-rō, Japanese philosopher, educator and statesman, assassinated at Kioto 15 Feb. 1869 for his liberal opinions. Born in Kumamoto in Higo, before 1810, his fame as a scholar in Chinese and as lecturer and expounder of the Oyoméi (q.v.) philosophy made the feudal castle lords compete for the honor of his presence and the use of his talents (1845–65), many of the makers of the New Japan being his pupils and carrying out his ideas. His best work was done in Fukui (q.v.). He opened a new chapter in the relations of the Orient with the Occident, when in 1865 he sent his two nephews to America for education at New Brunswick, N. J. When in 1867, after the *coup d'état* in Kioto, the new government was formed, the aged scholar was called to advise the new men in power, many of them his former pupils. Gaining their confidence, he proposed, after the example of Abraham Lincoln, that the outcasts, "éta" and "hinin" (not human) numbering nearly one million, should be raised to citizenship and that freedom of conscience be permitted. Attacked on his way home by the ronin ruffians in Kioto, he was shot and beheaded "for holding evil opinions," i.e. Christianity. All the assassins, except one, were caught and beheaded. On the proclamation of the Constitution by the Mikado in 1889, Yokoi was awarded posthumous honors. His son Tokiwo Yokoi is a notable writer in English. Consult Griffis, 'The Japanese Nation in Evolution' (1907); and 'The Rutgers Graduates in Japan,' (1916); and Armstrong, 'Light from the East' (1914).

YOKOSUKA, yō'kō-soo'kä, Japan, town and naval station on the Bay of Tokio, 12 miles south of Yokohama. It is connected with Yokohama by rail and steamer, and with Kamakura and Tokio by rail. It has a spacious land-locked harbor, large dry docks, a naval arsenal, and ship-building yards suitable for the construction of large war vessels. On these works several millions of dollars were spent in the first years of their operation, and their efficiency is being increased yearly. About a mile from the town is the grave of Will Adams (q.v.), the first Englishman to enter Japan. Pop. about 100,000.

YOKUTS ("Indians"), a group of about two dozen small tribes, forming the Mariposan linguistic stock of North American Indians, and occupying an irregular area in central southern California from Fresno River in the north to near the southern extremity of Tulare Lake in the south, and between the Sierra Nevada in the east and the Coast Range in the west; also a strip, 10 to 20 miles wide, extending southeastward from Tulare Lake along the eastern base of the latter range to Mount Pinos, about lat. 34° 45', together with an isolated area, occupied by the Cholovone division, in San Joaquin Valley from the Tuolumne northward. The tribes in general were segregated by the natural features of their territory, such as river valleys, and each tribe had its hereditary chief. Their village consisted of a single row of tule-thatched, wedge-shaped houses, with a continous *ramada* or shelter of brush along the front. In early times, when large game was abundant, hunting formed an important pursuit, but with the coming of the whites and the disappearance of the game they were compelled to resort almost exclusively to the products of the soil, the streams and lakes, although rabbits and quail were always abundant and were commonly trapped. Seeds of various kinds were gathered for use as food, as also were grasshoppers, caterpillars, worms and the larvæ of insects. Dogs were raised for the same purpose and even skunks were not despised; but the coyote and the rattlesnake were always tabooed. Their basketry, excellent in shape, design and execution, formed their chief handiwork. The Yokuts women were chaste before

the settlement of their country by the whites. Marriage was perhaps by purchase, the husband residing at the house of his wife; infanticide was practised in cases of deformity and the dead were generally cremated. The Yokuts are now but a remnant of a once comparatively populous group of tribes. Early warfare with the Paiutes, who pressed them closely from the east, and later and more disastrous contact with white ruffians who found the Indians in their way, practically exterminated many of the tribes. Their present population is about 500 of Indian habits and life. But numerous members of the race have been absorbed into the life of the nation and are no longer numerated as members of the Yokuts tribes.

YOM KIPPUR, a rabbinical term designating the Jewish Day of Atonement. See ATONEMENT.

YONEZAWA, yō'nā-zā-wā, Japan, a city in the northern centre of Hondo, which in Japanese annals had a long and interesting feudal history. Shut in on all sides by the mountains, it was a community apart. On the railroad, which strikes the west coast northward, it is famous for its silken fabrics which for over 150 years have had a reputation throughout the empire. Its old castle grounds, centre of song and story, is now a park and its temples are renowned. Pop. about 38,265.

YONGAMPO, yŏn-gām'pō, Korea, a seaport on the left bank of the Yalu estuary, near Wiju, with a large and important harbor. It was used as a landing place by the Japanese during the Chino-Japanese War in 1894, and just prior to the Russo-Japanese War of 1904 was an important outpost of the Russian advance into Korea and the headquarters of their timber-felling concession. Russia's strong protests against opening the port to foreign trade was one of the many events that hastened the war. See KOREA; JAPAN — RUSSO-JAPANESE WAR.

YONGE, Charlotte Mary, English author: b. Otterbourne, Hampshire, 11 Aug. 1823; d. there, 23 March 1901. She received a private education. She made her name widely known by the publication in 1853 of a novel entitled 'The Heir of Redclyffe,' which exercised an important influence on some High Church minds of that time. She devoted part of the proceeds to fitting out a missionary ship, *The Southern Cross*, for Bishop Selwyn. None of her later novels came up to the standard of 'The Heir of Redclyffe.' Among the best of them are 'Katharine Ashton'; 'The Daisy Chain' (1856), the proceeds of which she devoted to founding a missionary college at Auckland, in New Zealand; 'Hopes and Fears'; 'The Little Duke'; 'The Prince and the Page'; and 'The Dove in the Eagle's Nest.' Her staunch attachment to the Church of England more or less colors all these works, and was also manifested, not only in the field of practical effort, but in the choice of the subjects of some other of her works, such as 'Biographies of Good Women' (1862); 'Life of Bishop J. C. Patterson' (1873); 'John Keble's Parishes' (1898); and 'The Patriots of Palestine' (1898). Her later novels showed her to be out of touch with the new generation which had cast off the smug manners and pseudo-culture of the Victorian period. Her remaining works include 'Christian Names: their History and Derivation' (1863); 'Cameos from English History' (1869–99); 'History of Germany' (1877); 'History of France' (1879); 'Universal History for Young People.' For 30 years she edited a High Church magazine known as *The Monthly Packet*. An illustrated edition of her more popular works in fiction appeared in 1888–89. Consult Coleridge, Christabel, 'Life of Charlotte M. Yonge' (New York 1903) and Romanes, Ethel, 'Charlotte Mary Yonge, An Appreciation' (London 1908).

YONKERS, yŏnk'ĕrz, N. Y., city of Westchester County, on the Hudson River, and on the New York Central Railroad, north of and adjoining New York City. It has regular steamer connection, for passengers and freight, with New York and Albany, and is connected by electric lines with New York, Mount Vernon, New Rochelle and many of the villages and cities on the Hudson.

Industries.—The good opportunities for shipment of goods by land and water have aided the industrial growth of the city. In 1920 the estimated number of wage-earners in factories is 15,000, and the yearly production approximates $75,000,000. The carpet and rug mills alone employ over 5,000 people. There are very large foundries and machine shops, electric motor and electrical supplies factories, besides rubber works, large sugar houses, manufactories of patent medicines, fuels, etc., confectionery, furniture, roofing materials, clothing and hats. There are large coal yards, grain elevators, the Otis Elevator Company works, ship and boat building yards, bridge works, lumber mills, flour and grist mills and carriage and wagon factories. There are three daily and four weekly newspapers.

Municipal Improvements and Buildings.—Yonkers is built on a series of terraces which rise from the Hudson to an elevation of 426 feet above tide-water. The view from the elevated portions includes a long distance up and down the Hudson, the Palisades and the beautiful valley to the east. In the residential part of the city are the homes of many New York City business men. The city has a frontage of nearly five miles on the Hudson, and extends along the Bronx River for about seven miles. The streets, covering 115 miles, are broad, many of them paved, and well-shaded. The city owns and operates the waterworks. There are three small public parks maintained by the city, also two public bath houses, and, on the Hudson, a steel pavilion for recreation. There is an excellent sewer system. The principal public buildings are the government building, the library in Washington Park, the churches, schools and charity institutions. The city hall is of considerable historic interest; it was formerly the Philipse Manor and was built in 1752. Since 1868 it has been used as a municipal building. Another noted building is "Greystone," once the residence of Samuel J. Tilden.

Churches, Charitable and Educational Institutions.—There are 30 churches, some of which are buildings of considerable architec-

Yorkshire, 196 miles north-northwest from London by rail, at the confluence of the Foss with the Ouse. It consists of the city proper, and of suburbs, some portions of which are situated across the Foss, and communicate with the rest by several bridges. The city, with a circuit of nearly three miles, is enclosed by ancient double walls, originally Roman, but restored by Edward I, and partly repaired at subsequent periods; the portions which still remain have been converted into promenades, commanding a beautiful prospect of the surrounding country. York is entered by four imposing gates; and is built for the most part in narrow irregular streets, many lined with houses of antique appearance. Improvements have modernized many of the older parts of the city, and many handsome ranges of new buildings have been erected. The minster or cathedral dates from the 7th century, but did not begin to assume its present form till 1171, and was not completed till 1472. A square massive tower rises from the intersection to the height of 235 feet, and two other lofty towers of graceful proportion, 196 feet, flank a richly-decorated western front, divided by paneled buttresses into three compartments, of which that in the centre is chiefly occupied by a beautiful window and a splendid portal. Measured without the walls, the whole length, from east to west, is 524 feet, and the width across the transepts, north to south, 222 feet; length, from west door to choir, 264 feet; length of choir, 162 feet; breadth of body and side aisles, 109 feet. The interior consists chiefly of a lofty nave, separated from its aisles by long ranges of finely clustered columns, a still loftier choir, lighted by a magnificent and beautifully blazoned window, and a lady-chapel continuing the choir, and containing some beautiful monuments. The cathedral has twice sustained serious damage and narrowly escaped total destruction from fire, caused in 1829 by an incendiary lunatic, and in 1840 by the negligence of a workman engaged on its repair. The chapter-house, entered from the north transept of the cathedral, is a richly decorated octagon, and near it is a fine old chapel, originally forming part of the old archiepiscopal palace, and now appropriated to the library. York possesses many other places of worship, including a beautiful Roman Catholic pro-cathedral; and collegiate, grammar, blue-coat, gray-coat and board schools. Other notable buildings and establishments are an ancient Gothic guildhall (1446), and spacious mansion-house adjoining; the fine old ruins of Saint Mary's Abbey; Clifford's Tower, part of the city castle founded by the Conqueror; the fine old merchants' hall; county assize courts; city courts of justice in the late Gothic style (1892); the museum of the Yorkshire Philosophical Society, assembly-room, Masonic hall, baths, art-gallery, free library, the Yorkshire Club-house, concert rooms, two theatres, cemetery, lunatic and blind asylums, dispensary, county hospital, cattle market, almshouses and numerous other charities. The railway station is one of the finest in England. The manufactures include iron castings, bottles, leather, flour, cocoa, gloves, glass, flax spinning, linen and confectionery. York ranks second among English cities, its archbishop having the title of Primate of England (see ARCHBISHOP); its chief magistrate takes the title of lord-mayor. It is the headquarters of the North-Eastern Railway Company and contains their carriage and wagon shops. There is communication by water with Selby, Goole, Hull, etc. York was the early British Caer Ebroc of the Brigantes and under the Romans as Eboracum became their principal seat of power in the north, if not in the whole country. Here died the Roman emperors Severus and Constantius Chlorus, and here it is popularly (but incorrectly) supposed Constantine the Great was born. After their departure it so far retained its importance as to become the capital of Northumbria, whose king, Edwin, in 624 made it an archiepiscopal see. In the 8th century its diocesan school attracted students not only from all parts of the kingdom, but from France and Germany, and sent out scholars who afterward acquired European celebrity. Here the first English Parliament was held by Henry II in 1160. In after-times it makes a distinguished figure in almost all the great epochs and events of English history, during the Civil War surrendering to the Parliamentarians after a siege of several weeks, subsequent to their victory at Marston Moor in the vicinity. Among its distinguished natives are Alcuin, the tutor to the family of Charlemagne; Flaxman the sculptor; and William Etty the painter. Pop 82,282. Consult Drake, F., 'Eboracum: or the History and Antiquities of the City of York' (1843); Raine, J., 'York' (1893); Purey-Cust, A. P., 'York Minster' (1897); Rowntree, B. S., 'Poverty: A Study of Town Life' (1901).

YORK, Me., town, port of entry, York County, on York River, and on the Boston and Maine Railroad, about 45 miles south by west of Portland and 100 miles southwest of Augusta. It is in an agricultural region, but is known as a favorite summer resort. It has a number of buildings of historic interest, among which is the jail, which is one of the oldest in the country. It contains several villages in which are many summer cottages. The town was set off, in 1622, from land granted by the Plymouth Council to John Mason and Ferdinand Gorges. In 1624 the place was called Agamenticus. On 1 March 1640 a territory of 21 square miles was incorporated as a borough by Gorges, and chartered as the city of Gorgeana in 1642. This was the first municipal corporation made by the English in North America. On the death of Charles I, in 1649, Georgeana City, Isle of Shoals, Wells and Kitterytown united and established a confederacy. In 1652 the confederacy and all of Maine came under the control of Massachusetts. The city charter of Georgeana was revoked, and the name changed to York. The limits of the present town are about as in 1652. In the early years the town suffered from Indian depredations; one attack, in 1692, resulted in the massacre or capture of about one-half the inhabitants. The population is about 3,000. Consult Emery, G. A., 'Ancient City of Gorgeana and Modern Town of York' (Boston 1873); Baxter, J. P., 'Sir Ferdinand Gorges and His Province of Maine' (1890); id., 'Agamenticus, Bristol, Gorgeana, York' (Portland 1904); Bouvé, Pauline C., 'Old York, a Forgotten Seaport' (in *New England Magazine*, July 1902).

YORK, Neb., city, county-seat of York County, on the Chicago, Burlington and

Quincy and the Chicago and Northwestern railroads, 50 miles west of Lincoln. It was settled in 1871 and in 1880 was incorporated. It is in agricultural and stock-raising region, and its industries are connected chiefly with farm products. It has a flour mill, machine shop, foundry, large stock yards and grain elevators and a good Federal post office. The educational institutions are York College (U.B.), opened in 1890; a high school, established in 1880; the Holy Family Academy (R.C.); a prosperous business college; four ward schools and parish elementary schools and public school libraries. The State Odd Fellows Home and the Mothers Jewels Home (M.E.) are located here. There are two national banks with a combined capital of $500,000 and two State banks with a combined capital of $100,000; also one daily and three weekly papers. There are 15 miles of paved streets, four parks with shade trees and drives, and a paid fire department with modern fire apparatus. Pop. 7,500.

YORK, Pa., city, county-seat of York County, on the Condorus Creek, and on the Pennsylvania, the York Southern, the Northern Central and the Western Maryland railroads, about 28 miles southeast of Harrisburg, and 95 miles west of Philadelphia. It is in a productive farming section and has considerable manufacturing interests.

In 1914 (government census) the city had over 500 manufacturing establishments, capitalized for $29,328,000, with an output valued at $21,969,000. The foundry and machine finished products are the largest industry, closely followed by the tobacco products. Other manufactures of which there are large and valuable outputs annually are agricultural implements, cigar boxes, food products, carriages, wagons, carriage and wagon materials, confectionery, flour and grist mill products, furniture, iron and steel products (including nails, spikes, wire nails, etc.), lumber products, paper and wood pulp, shirts and patent medicines. The vast power generated at Yorkhaven, 11 miles north of York, has greatly increased the manufacturing industries of York. There is an extensive trade in the manufactured products and in general merchandise which is distributed to the villages and towns of a large region. The surface is slightly rolling and has sufficient slope to make excellent drainage. The streets are broad and well shaded. The city is laid out in sections or blocks, 520 feet long and 480 feet wide. There are seven beautiful parks, of which the principal are Highland, Farquhar and Penn. The principal public buildings are the government building, the courthouse, county jail, the Masonic Temple, four market buildings, an opera house, three public halls and the municipal buildings. There is an excellent water-supply and a good sewerage system. There are over 60 churches, representing 16 different denominations. The principal charitable institutions and hospitals are the city hospital, charity hospital, county almshouse, Children's Home, Christian Home and private sanatoriums. The educational institutions are York Collegiate Institute (Presb.); York County Academy, founded in 1787; two business schools, Saint Patrick's Academy (R.C.); a public high school, founded in 1870; public and parish schools, a public library, York County Law Library, and Saint John's Church free library. There are five national, three State and two private banks.

The government is administered on the commission plan, which provides for a mayor, elected for four years, and four commissioners elected for two years.

A permanent settlement was made in 1735 by a German colony; but in 1741 the town was laid out by John, Thomas and Richard Penn, and incorporated as a borough in 1787. In 1887 York was chartered as a city. In 1749 the first Court of General Quarter Sessions was held here. In 1777 the Continental Congress left Philadelphia, fearing capture by Howe's army, and convened in York 30 September. Congress continued to hold sessions in York until 27 June 1778. Pop. 50,543. Consult Gibson, 'History of York County' (Chicago 1886).

YORK, a river in Virginia, formed by the confluence of the Pamunkey and Mattapony rivers. It is the tidal estuary of the rivers, which begins at West Point and flows southeast to the Chesapeake Bay, into which it empties about 18 miles north of the James River. It is 40 miles long and navigable to the head of tide water. At its entrance, on York Spit, is a lighthouse.

YORK, Battle of, in the War of 1812. Perry's victory at Lake Erie (q.v.) and Harrison's defeat of Proctor at the Thames (q.v.) successfully concluded one part of the campaign for the invasion of Canada. As the next step Gen. Henry Dearborn (q.v.) planned to capture York (now Toronto), besiege Fort George (q.v.) by land and water, and then move on to Kingston after being joined by the troops at Buffalo, which were to capture Forts Erie and Chippewa. Leaving Sackett's Harbor (q.v.) defenseless, Com. Isaac Chauncey (q.v.), with 14 vessels, carrying 112 guns and 980 men, conveyed Dearborn, Zebulon M. Pike (q.v.) and 1,600 troops to York, which was attacked on the morning of 27 April 1813. The British garrison of 600 regulars and militia under Major-General Sheaffe were driven back toward their main works but when about 60 yards away a powder magazine was exploded by the British causing great havoc and killing about 40 British and 100 American soldiers, Pike being among those mortally wounded. Nevertheless the Americans pressed forward and finally drove the regulars toward Kingston and captured the militia, besides large quantities of stores and a 10-gun brigade. The public buildings were then set afire. The American loss was about 320 killed and wounded and the British 90 killed, 200 wounded and 300 prisoners. This paved the way for the capture of Fort George (q.v.) and the later battles of Stony Creek, Beaver Dam, Chrystler's Farm, Chateaugay, Lacolle Mill, Fort Erie, Chippewa, Lundy's Lane, Plattsburg and Lake Champlain (qq.v.). Consult Wiley and Rines, 'The United States,' Vol. V, pp. 402–405; Roosevelt, 'Naval War of 1812,' pp. 224–230; Whitney, Henry, 'Life of Pike'; 'American State Papers, Military Affairs,' Vol. I, pp 442–444; Maclay, E. S., 'History of the Navy,' Vol I; Cooper, J. F., 'Naval History,' Vol. II; histories of the war by Lossing, Brackenridge and Armstrong.

Courtesy of the Bookhovers Magazine

VILLAGE STREET IN YORKTOWN

Trunk railways. There are Dominion land and lands title offices here. Manufacturing is of increasing importance. Pop. about 2,309.

YORKTOWN, Va., town, county-seat of York County, on the York River, seven miles from its mouth and 68 miles southeast of Richmond. It has regular connection with the Chesapeake and Atlantic ports by means of the Old Dominion and other lines of steamers. York is one of the oldest settlements of the United States; it contains the oldest custom-house in the country. It is famous for having been the place where Lord Cornwallis surrendered, and a monument has been erected in honor of the event. This was the last important battle of the Revolutionary War. (See YORKTOWN, SIEGE OF, IN THE WAR OF THE AMERICAN REVOLUTION). Yorktown was the scene of a second siege during the Civil War. (See YORKTOWN, SIEGE OF, IN THE CIVIL WAR). Pop. 136.

YORKTOWN, Siege of, in the Civil War. On 4 April 1862 General McClellan, with 58,000 men and about 100 guns, started from Fort Monroe up the York Peninsula for his campaign against Richmond. His plan of operation was to move in two columns, one on the right direct to Yorktown and another along the James River westward of and beyond Yorktown to the vicinity of Williamsburg. Should the Confederate works at Yorktown and Williamsburg offer serious resistance he designed to land General McDowell's First Corps, reinforced if necessary, on the left bank of the York or on the Severn, and move it on Gloucester and West Point, in order to take in reverse whatever force the enemy might have on the peninsula and compel him to abandon his positions. At the end of the first day's march General Heintzelman's Third Corps on the right bivouacked at Howard's Bridge and Cockletown beyond, and General Keyes' Fourth Corps on the left, at Young's Mill, near James River. On 5 April Keyes resumed his march for the Halfway House, between Yorktown and Williamsburg, but had hardly got on the road when it was ascertained that a large force of the enemy, with a battery, was at Lee's Mills, six miles beyond, barring the way over the Warwick, concerning the direction of which McClellan was misinformed. Keyes advanced and in the afternoon found the situation as reported; and after some artillery-firing he encamped for the night. On the right Heintzelman advanced to near Yorktown, came under artillery-fire from the works and encamped fronting them, where he was destined to remain a full month. Yorktown, as well as the line of the Warwick southward to James River, was held by Gen. J. B. Magruder with about 11,000 men. For 10 days McClellan remained in front of Magruder, making some reconnoissances, but no serious demonstrations, although urged by President Lincoln on 6 April to move upon and break the enemy's line. McClellan was instead engaged in bringing up troops and guns preparatory to a regular siege and was asking for heavy reinforcements and more heavy siege-guns. He adopted the slow method of a siege because of his exaggerated idea of the Confederate strength in his front, although he at no time estimated the forces of Magruder at more than 15,000 to 20,000 and his own initial strength of 58,000 men had been increased to 100,970 men present for duty according to his report of 13 April. He declared himself seriously weakened by the fact that McDowell's Corps of 33,400 men, which he had proposed using to flank Yorktown, by Gloucester and West Point, had been withheld from him to protect Washington which had been left with a guard of less than 20,000 raw troops. (See PENINSULA CAMPAIGN OF 1862). However, at McClellan's urgent request Franklin's Division was sent him 10 April, but these troops were held aboard their transports until after the evacuation of Yorktown. On 16 April an attempt was made upon Magruder's lines at Lee's Mill (q.v.) by a reconnoitering force of 200 men who were not reinforced, but resulted in failure, and McClellan, giving up the idea of carrying the Confederate position by assault, devoted his attention entirely to siege operations against Yorktown. Under the direction of Gen. Fitz-John Porter, who was made director of the siege, Gen. J. G. Barnard, chief of engineers, and Gen. W. F. Barry, chief of artillery, the operations were conducted elaborately and with great skill. General Barry reports that the siege train consisted of 101 pieces, as follows: "Two 200-pounder Parrot rifled guns, eleven 100-pounder Parrot rifled guns, thirteen 30-pounder Parrott rifled guns, twenty-two 20-pounder Parrott rifled guns, ten 4½-inch rifled siege guns, ten 13-inch sea-coast mortars, ten 10-inch sea-coast mortars, fifteen 10-inch siege mortars, five 8-inch siege mortars, and three 8-inch siege howitzers. Three field batteries of 12-pounders were likewise made use of as guns of position." These guns were mounted on very elaborate works, some 15 in number, established opposite the town, and the works to its right, at ranges varying from 1,500 to 2,200 yards. In number and weight of metal they were far superior to those of the Confederates. On 17 April Gen. J. E. Johnston had been assigned to the defense of the peninsula and Richmond, and he had on the Yorktown and Warwick line not to exceed 50,000 men. He made no strenuous effort to interfere with McClellan's operations, but determined to hold his position until McClellan was ready to attack and then to fall back without waiting to have his troops driven from their works. By 30 April McClellan had present for duty 112,392 men, including Franklin's division that had been sent to him to turn Yorktown by Gloucester Point or West Point. On 1 May McClellan proposed to open fire on the morning of 6 May with all his guns and to press the siege until final assault should be deemed practicable. But on 27 April Johnston had learned that McClellan's batteries were approaching completion and would be ready to open fire in five or six days and he made his dispositions for retreat. On the night of 3 May, leaving some serviceable heavy guns behind, he evacuated Yorktown and fell back to Williamsburg on the way to Richmond.

Consult 'Official Records' (Vol. XI); 'McClellan's Own Story'; Webb, 'The Peninsula'; Barnard, 'Peninsular Campaign'; Allan, 'History of the Army of Northern Virginia'; The Century Company's 'Battles and Leaders of the Civil War' (Vol. II); Nicolay and Hay, 'Abraham Lincoln' (Vol. V, 1890).

E. A. CARMAN.

YORKTOWN, Siege of, in the War of the American Revolution, Lord Cornwallis

and the British army, a force of 8,000 men, reached Virginia in May 1781 and in the following August invested Yorktown, on the York River, throwing up earthworks and fortifying the town; he also erected fortifications at Gloucester Pond, opposite Yorktown, and was supported by several British vessels in the York River. Washington feigning activity around New York, left his headquarters on the Hudson 19 August, traveled by land to Philadelphia, then to Elktown at the head of Chesapeake Bay and arrived at Williamstown 14 September. His force consisted of 7,000 French under Rochambeau and 9,000 Americans. On 29 September he invested Yorktown, taking over the command from Lafayette. Meantime, on 28 August, the French fleet of Count de Grasse, numbering 28 ships of the line, with nearly 4,000 infantry on board, reached the Chesapeake and came to safe anchor in the mouth of York River. Cornwallis was securely blockaded both by sea and land, the land forces under Lafayette being sufficient to hold him until Washington's arrival with reinforcements. Just after the arrival of Count de Grasse came also Count de Barras, who commanded the French flotilla at Newport. He brought with him into the Chesapeake eight additional ships of the line and 10 transports; also cannon for the siege of Yorktown. By the beginning of September York River was effectually closed at the mouth and the Americans and the French began to strengthen their lines by land. On 5 September the English Admiral Graves appeared in the bay with his squadron, and a naval battle ensued, in which the British ships were so roughly handled that they were glad to draw off and return to New York. The allied armies, now greatly superior in numbers to the enemy, and confident of success, encamped closely around Yorktown and the siege was regularly begun. The first parallel trench was opened 6 October and completed 9 October, when the Americans opened fire and the cannonade became constant and effective. The second parallel was opened 11 October and on 13 October, in the night, the Americans made an assault and the outer works of the British were carried by storm. At daydawn on 16 October the British made a sortie from their entrenchments with 350 men and succeeded only in spiking a few guns which were promptly restored to action before they were driven back. Cornwallis then attempted a night escape by boat forces, leaving his sick, wounded and baggage behind, but a terrific storm frustrated the plan. On 17 October Cornwallis proposed to surrender, and on the 19th Major-General O'Hara led out the whole British army from the trenches into the open field, where, in the presence of the allied ranks of France and America, 7,247 English and Hessian soldiers laid down their arms, delivered their standards, and became prisoners of war; the garrison forces becoming prisoners of the United States, while the sea forces were prisoners of the French. The allied American and French losses were about 300 killed, wounded and missing. The British losses were about 550. This was the last important battle of the Revolutionary War.

YORKVILLE, S. C., town, county-seat of York County, on the Carolina and Northwestern and Southern railroads, about 85 miles north of Columbia. It is in an agricultural region, in which are valuable deposits of iron. It has iron works, machine shops, a saddle and harness factory, spoke and handle works, and lumber mill. There are seven churches and two graded schools (including high school departments), one for colored and one for white pupils. The savings bank has a capital of $50,000. Pop. 2,326.

YORUBA, yō'roo-bă, or **YARRIBA**, yă'rē-bă, Nigeria, West Africa, a former independent state situated north and northeast of the colony of Lagos, extending from Benin on the east to Dahomey on the west and north to Borgu, its area being about 25,000 square miles, most of which is now a part of the British Protectorate of Southern Nigeria. Its history in European knowledge dates to the 17th century, at which time it was an empire consisting of six strong confederate states. About 1830 the empire, weakened by Moslem influences and Tula invaders, broke into a number of weak, quarreling states. They came under British protection in 1893, and while only semi-independent have not lost their sense of nationality. They contrive, also, to preserve most of their government and customs. Much of the country is fertile and well cultivated, and the inhabitants have made great progress in the industrial arts. They are of negro stock but many have light skins, probably due to an infusion of Arab and Berber blood. There is a tradition among them of Oriental origin. Their country was repeatedly raided by slave hunters, and many American negroes are said to have come from there. Their houses are well built, those of their chiefs containing great numbers of rooms. They are largely pagans, but Mohammedanism and Christianity have made way among them. Protestant and Roman Catholic missions have long been at work. Ibadan, to which there is a railway from Lagos, is the largest town, having about 200,000 inhabitants; Oyo, farther to the north, is the capital. Population estimated at between 1,000,000 and 2,000,000.

YOSEMITE, yō-sĕm'ĭ-tē (Indian, "full-grown grizzly bear") **VALLEY**, in Mariposa County, Cal., on the west slope of the Sierra Nevada, about 150 miles, in direct line, east of San Francisco. This valley is one of the natural wonders of America and is unlike any other known valley in the world. It is about six miles long and from half a mile to a mile wide. It is nearly a mile below the general level of the land near it. Entering the valley from the lower end, the two distinct valley types may be seen, the V-shaped and the U-shaped. (See VALLEYS). It has the characteristics of a gorge and also of a cañon and was eroded from the surrounding granite by glacial action. It is nearly 4,000 feet above sea-level and its walls of granite from 3,000 to nearly 5,000 feet higher. On the north side is a huge block of granite called El Capitan. It projects into the valley so that two of its smooth, almost perpendicular faces are visible; the height is 7,042 feet. Opposite El Capitan are Cathedral Rocks and Bridal Veil Rock. From the summit of El Capitan to the summit of Bridal Veil Rock is one mile; but at the base of the rocks the distance apart is not great.

Blackwater, 27 miles east of Cork. The parish church is formed of the nave and aisles of the ancient collegiate church, built by the Earl of Desmond in 1464; the "water gate," the "clock gate" and Sir Walter Raleigh's house, Myrtle Grove, are other notable features. The export of agricultural produce and the fisheries are the chief industries. According to local tradition the potato was first planted at Youghal by Raleigh, who was mayor in 1588. Pop. 5,393.

YOUMANS, yoo'manz, **Edward Livingston,** American scientist: b. Coeymans, N. Y., 3 June 1821; d. New York, 18 Jan. 1887. Partially blind at times through many years of his life, he pursued his studies by the aid of his sister, Eliza Ann Youmans, and became widely known as a popularizer of science. He lectured extensively and in 1872 founded *The Popular Science Monthly,* which he edited till his death and established the 'International Scientific Series,' in which the works of Herbert Spencer and other prominent scientists were presented to American readers. The volumes of this series were published simultaneously in different languages in London, Paris, New York, Leipzig, Petrograd and Milan. Author of 'Chemical Chart' (1851); 'Handbook of Household Science' (1857); 'Culture Demanded by Modern Life' (1867), etc.

YOUMANS, William Jay, American chemist, brother of E. L. Youmans (q.v.): b. Milton, Saratoga County, N. Y., 14 Oct. 1838; d. Mount Vernon, N. Y., 10 April 1901. He studied chemistry at Columbia College and at the Sheffield Scientific School, New Haven, and was graduated from the medical department of the New York University in 1865 and practised his profession for a time at Winona, Minn. In 1871 he was called to assist his brother, who had planned to publish *The Popular Science Monthly,* and from that time till 1900 was actively connected with the management and editorship of that periodical. He edited 'Pioneers of Science in America' (1895); Huxley's 'Lessons in Elementary Physiology,' adding a second part, 'Elementary Hygiene' (1867) and was author of 'Pioneers of Science in America' (1895).

YOUNG, Alexander, American Unitarian clergyman: b. Boston, 22 Sept. 1800; d. there, 15 March 1854. He was graduated at Harvard in 1820, studied theology at Cambridge, and in 1825 became pastor of the New South Congregational Church in Boston, which office he held till the close of his life. He was famous as a delineator of character and his discourses in memory of prominent men of his acquaintance, among which were 'Nathaniel Bowditch' (1838); 'President Kirkland of Harvard' (1840), and 'Judge William Prescott, father of the historian' (1844), were widely read. He published 'Chronicles of the Pilgrim Fathers of the Colony of Plymouth' (1841); 'Chronicles of the First Planters of the Colony of Massachusetts Bay' (1846); 'Library of Old English Prose Writers' (9 vols., 1831–34), etc.

YOUNG, Andrew White, American political economist: b. Carlisle, N. Y., 2 March 1802; d. Warsaw, N. Y., 17 Feb. 1877. He was for many years a newspaper editor, served in the State legislature and was author of 'Introduction to the Science of Government' (1835); 'First Lessons in Civil Government' (1843); 'Citizen's Manual of Government and Law' (1851); 'The American Statesman: A Political History of the United States' (1855); 'National Economy: A History of the American Protective System' (1860).

YOUNG, Arthur, English agricultural writer: b. London, 11 Sept. 1741; d. there, 20 April 1820. He was intended for a mercantile career, but early adopted the profession of agriculture, carrying on farms at various places, and especially on his paternal estate, near Bury Saint Edmunds. He soon became famous as a writer on farming and allied topics and especially for his agricultural tours. He also carried on an extensive correspondence with public men both at home and abroad, Washington being one of his correspondents. In 1784 he began the publication of his 'Annals of Agriculture,' of which 46 volumes were issued. This work had the most important influence upon the art of agriculture in England and a considerable portion of it was translated into French under the auspices of the government. In 1793 he was appointed secretary of the newly erected board of agriculture, with a salary of £400 a year. Young not only visited and examined with great attention many parts of England and Ireland, but also made several tours on the Continent. His work was highly important, not only in its service to agriculture but from the standpoint of social and political observation. He became blind some years before his death. Among his numerous works are 'The Farmer's Letters to the People of England' (1767; enlarged edition 1777); 'Six Weeks' Tour through the Southern Counties' (1768); 'Six Months' Tour through the North of England' (1770); 'Farmer's Guide' (1770); 'Farmer's Tour through the East of England' (1771); 'The Farmer's Calendar' (1771); 'Tour in Ireland' (1780); 'Travels in France during the Years 1787–89' (1792–94); treating of agriculture and national resources, the social and political condition of the people, the most trustworthy source of information regarding the state of France on the eve of the Revolution; 'Essays on Manures' (1804); 'The Rise of Prices in Europe' (1815). By order of the French Directory his agricultural works were published in French in 20 volumes entitled 'Le Cultivateur Anglais' (1800–01). Consult Leslie, Stephen, 'Studies of a Biographer' (1898); his Autobiography edited by Miss Betham Edwards (1898); and bibliography by Anderson in Hutton's edition of 'Tour in Ireland' (1892).

YOUNG, Brigham, president of the Church of Jesus Christ of Latter-day Saints (commonly called the "Mormon" Church) from 1844 to 1877; b. Whittingham, Vt., 1 June 1801; d. Salt Lake City, 29 Aug. 1877. In early life he moved to Cayuga County, N. Y., where he followed the occupation of carpenter and glazier. In 1829 he moved to Mendon, N. Y., where he obtained from Samuel H. Smith, brother of Joseph Smith, the prophet, a copy of the Book of Mormon. His investigation resulted in his conversion and he joined the Church, being baptized and confirmed 14 April 1832. He was ordained an elder and immediately began active service in the ministry, preaching and baptizing in the regions about Mendon. When the main body of the Latter-day Saints settled

YOUNG, Edward, English poet: b. Upham, Hampshire, 3 July 1683; d. Welwyn, Hertfordshire, 5 April 1765. He was educated at Oxford and in 1708 was nominated to a law fellowship in All Souls College. Befriended by the Duke of Wharton, an annuity of £100 was granted him by the duke. In 1719 and 1821, respectively, appeared his tragedies of 'Busiris' and 'Revenge,' both produced at Drury Lane. In 1725 he began the publication of a series of satires, 'The Universal Passion.' He now took holy orders and in 1728 was nominated one of the royal chaplains. In 1730 the College of All Souls presented him with the rectory of Welwyn, in Hertfordshire, to which the lordship of the manor was attached. In 1731 he married Lady Elizabeth Lee, daughter of the Earl of Lichfield, and after his marriage the poet lived much in retirement at Welwyn, sadly disappointed that church preferment, which he so eagerly desired and so unscrupulously belauded those in power to obtain, was refused him. The work by which he is best known is 'The Complaint, or Night Thoughts on Life, Death and Immortality' (1742–45), a series of argumentative poems in blank verse, intended to prove the immortality of the soul and the truth of the Christian religion — a work displaying great force of pious and somewhat gloomy reflection, and containing many lofty passages, but marred by a straining after antithesis and ornament. The 'Night Thoughts' were translated into French and German and were as popular on the Continent as at home. Of Young's three tragedies, 'Busiris' (1719); 'The Revenge' (1721); and 'The Brothers' (1753), only the second has kept a place on the stage. His 'Night Thoughts' has never since ceased to be popular and many of its sententious lines have become proverbial. The poem is not destitute of real excellence, but a note of insincerity runs through it and the poet too often substitutes pomposity for dignity. Consult Mitford edition of Young's 'Poetical Works' with 'Life' (1854); Thomas, 'Le poète Edward Young' (1901); 'Worldliness and Other-Worldliness,' by George Eliot, in *Westminster Review* for 1857, reprinted in her 'Essays and Leaves from a Notebook' (1884).

YOUNG, Ella Flagg, American educator: b. Buffalo, N. Y., 15 Jan. 1845; d. Washington, D. C., 26 Oct. 1918. She was educated at the Chicago Normal School, and took the degree of Ph.D. at the University of Chicago in 1900. She engaged in teaching in 1862, and was married to William Young in 1868. She was appointed superintendent of schools in Chicago in 1887, and in 1899 she became professor of education at the University of Chicago. She served as principal of the Chicago Normal School in 1905–09, and in 1909 she again became superintendent of Chicago schools, resigning in 1915. She was actively connected with various educational associations, and was in 1910–11 the first woman president of the National Education Association. In 1906–09 she edited the *Educational Bi-Monthly*. She published 'Isolation in the School' (1901); 'Ethics in the School' (1902); 'Some Types of Modern Educational Theory' (1902), etc. Consult McManis, John T., 'Ella Flagg Young' (Chicago 1916).

YOUNG, Franklin Knowles, American author and inventor: b. Boston, Mass., 21 Oct. 1857. He is the inventor of an automatic breech action for small arms and field artillery. Author of 'The Minor Tactics of Chess' (1894); 'The Major Tactics of Chess' (1898); 'Grand Tactics of Chess' (1898); 'Chess Strategics Illustrated' (1900); 'Napoleon's Campaigns.'

YOUNG, Sir Frederick, English publicist: b. London, 21 June 1817; d. 9 Nov. 1913. He was formerly a London merchant and traveled extensively in Greece, Turkey, South Africa and Canada. He was active in securing Victoria Park, London and Epping Forest to the public, and in establishing the People's Palace. He took great interest in emigration and was one of the earliest advocates of imperial federation. He published 'Long Ago and Now' (1863); 'New Zealand: Past, Present, and Future'; 'A Winter Tour in South Africa' (1890); 'A Scheme for Imperial Federation' (1895); 'Exit Party' (1900); 'A Pioneer of Imperial Federation in Canada' (1902), etc., and edited 'Imperial Federation' (1876).

YOUNG, Frederick George, American educator: b. Burnett, Wis., 3 June 1858. He was graduated at Johns Hopkins University in 1886; was vice-principal of the State Normal School, in Madison, S. Dak., 1887–90; principal of the Portland High School, Ore., 1890–94; president of Albany College, Ore., 1894–95; and was appointed professor of economics and history in the University of Oregon in the year last named. Since 1908 he has been secretary of the Oregon Conservation Commission. He edited 'Sources of the History of Oregon,' and is editor of the 'Quarterly Journal of the Oregon Historical Society.' Author of 'Exploration Northward' (1898); 'The Lewis and Clark Expedition in American History' (1901); 'Procedure for Tax Reform in Oregon' (1909), etc.

YOUNG, George Ulysses, American mine owner and public official: b. Hamburg, Ind., 10 Feb. 1867. His parents emigrated to Kansas in 1880, and two years later, he began teaching school. He was admitted to the bar in 1890, and worked for several years in railroad construction. He was principal of the Williams schools (Arizona) for four years, and while there was owner of the Williams *News*, with Capt. W. O. O'Neill. Since 1903 he has been in the mining business, becoming vice-president and general manager of the Madizelle Mining Company, and president of the Young Mines Company. In 1916 he was elected mayor of Phœnix, Ariz., the first to serve under the commission form of government. From 1909–12 he was territorial secretary of Arizona.

YOUNG, James, Scottish chemist: b. Glasgow, 13 July 1811; d. 14 May 1883. He began his career as a cabinetmaker, but in the evenings studied chemistry under Professor Graham in Anderson's College, Glasgow, and became his assistant both there and afterward at University College, London (1832–38). Receiving appointments in chemical works at Manchester and elsewhere, he discovered a method of distilling oil from bituminous shale, and thus became the founder of the mineral-oil industry of Scotland, besides leading to the development of the petroleum industry in

action against General Lee. At the close of the Civil War he entered the regular army as second lieutenant, took part in the Indian Wars, commanded a brigade at Santiago, and won a decisive victory at Las Guasimas 24 June 1898. In 1899 he was in charge of the cavalry advance of Lawton's Division in its march through northern Luzon, and for his services was appointed military governor of northwestern Luzon; and later commander of the first district of the Department of Northern Luzon. He was then appointed commander of the Department of California. In 1902 he became first president of the Army War College Board, chief of staff and lieutenant-general of the army. He was retired 9 Jan. 1904. In 1909–10 he was president of the Brownsville Court of Inquiry; and since May 1910, has been governor of the Soldiers' Home at Washington, D. C.

YOUNG, Samuel Hall, American Presbyterian clergyman: b. Butler, Pa., 12 Sept. 1847. He was graduated at the University of Wooster, Ohio, in 1875, and at the Western Theological Seminary, Allegheny, Pa., in 1878; and ordained in the Presbyterian ministry in 1878. Going to Fort Wrangel, Alaska, as a missionary and explorer in 1878, he organized the first Protestant church in Alaska in 1879; and afterward held pastorates in California, Illinois, Iowa and Ohio. Sent to the Klondike in 1897, he established the First Presbyterian Church in Dawson in 1898; and organized missions in Eagle, Romfort, Nome and Teller. In 1901 he was appointed superintendent of all the Presbyterian missions in Alaska, which office he filled until 1913, when he became special representative for Alaska of the Presbyterian Board of Home Missions with headquarters in New York.

YOUNG, Thomas, English physicist and archæologist: b. Milverton, Somerset, 13 June 1773; d. London, 10 May 1829. He was of Quaker parentage, and at the age of 14 possessed a remarkable knowledge of Latin, Greek, French, Italian, Hebrew, Persian and Arabic. He studied medicine at London and Edinburgh, taking his M.D. at Göttingen in 1796 and later studying at Cambridge. As early as 1799 Young wrote his celebrated memoir on the 'Outlines and Experiments respecting Sound and Light,' which speedily conducted him to the discovery and demonstration of the interference of light. This discovery alone, according to Sir J. Herschel, would have sufficed to have placed its author in the highest rank of scientific immortality. He described astigmatism in 1801; formulated a correct theory of color perception; and made important contributions to hæmadynamics. In 1801 he became professor of natural philosophy at the Royal Institution, and in 1802 foreign secretary to the Royal Society — an office which he held for the remainder of his life. The series of lectures delivered in connection with his professorship form the substance of his great work, 'Natural Philosophy and the Mechanical Arts' (1807). In 1811 he was elected physician to Saint George's Hospital. In 1818 he was appointed secretary to the board of longitude, superintending the 'Nautical Almanac.' He became also a linguist of high ability and is known for his successful pioneer work in deciphering Egyptian hieroglyphic inscriptions and working out the hieroglyphic alphabet. He was author of many scientific papers and of 'An Account of Some Recent Discoveries in Hieroglyphical Literature and Egyptian Antiquities' (1823). Consult Peacock, 'Life of Young,' and 'Miscellaneous Works,' edited by Peacock and Leitch (1855).

YOUNG, Sir William, Canadian jurist and statesman: b. Falkirk, Scotland, 8 Sept. 1799; d. Halifax, Nova Scotia, 8 May 1887. He was educated at Glasgow University, and later joined his parents in Nova Scotia, where he was admitted to the bar in 1826. He was elected to the legislature of Nova Scotia in 1832, and in 1839 he was, with Herbert Huntington, delegated to go to England to urge the establishment of a responsible government for Nova Scotia. He was appointed a member of the Executive Council in 1842, and in 1843–54 he was speaker of the legislature. He was Premier and Attorney-General of Nova Scotia in 1854–57, and was again Premier in 1859–60. He then retired from politics, and was appointed Chief Justice of the Supreme Court of Nova Scotia in August 1860. He was knighted in 1868; and in 1881 he retired from the bench.

YOUNG, William, American poet and dramatist: b. Illinois 1847. He has published 'Wishmakers Town,' poems (1885–98); and the plays: 'Jonquil' (1871); 'The Rogue's March' (1872); 'Pendragon,' verse (1881); 'The Rajah' (1883); 'Ganelon,' verse (1888); 'The Home of Mauprat,' with J. G. Wilson (1882); 'Joan of Arc,' adaptation in verse (1890); 'If I Were You' (1892); 'Young America' (1894); 'The Princess of Bagdad' (1896); 'Ben Hur,' dramatization (1899); 'Woman's Wiles' (1898); 'The Sprightly Romance of Mersac' (1900); 'Oh, What Riddles these Women Be!'; narrative poem (1900); 'A Japanese Nightingale' a dramatization (1903); and 'The Sea-Green Man' (1907).

YOUNG ENGLAND, a political party active in London about 1844 and led by Mr. Disraeli, after he had begun to oppose the general policy of Sir Robert Peel. Besides its founder it contained some young men of ability and position, prominent among them being Lord John Manners, later Duke of Rutland; George Smythe, afterward Viscount Strangford; and Baillie-Cochrane, afterward Lord Lamington. Its program was the reconciliation of the aristocracy and the Church on the one hand, and the people on the other; and its adherents sought to re-establish the political ascendency of the aristocracy by demonstrating its ability to govern. Its principles were attractively expounded in Disraeli's two fictions, 'Coningsby' and 'Sybil.'

YOUNG GERMANY, a group of literary and political innovators in Germany, headed by Heine (q.v.). Its followers were devoted to the promotion of liberal ideals in literature and in politics, among them being Börne, Gutzkow, Laube, Heller and Kuhne. The movement was strongest in the 1830's and collapsed after the failure of the revolution of 1848.

YOUNG IRELAND, the name applied to an Irish political group, active between 1840

and 1850. They at first adhered to O'Connell, but soon became very radical in their opinions; advocated physical force, and separated from the conservative Irish politicians in 1844. *The Nation* was their political organ and in this journal the Irish people were constantly incited to revolt. In 1848 John Mitchell (q.v.), one of the leaders of the party, was arrested and sent to Tasmania, and the attempted insurrection which followed soon collapsed, two of the leaders, T. F. Meagher (q.v.), and W. S. O'Brien (q.v.), being sentenced to death, but their sentences were presently commuted to transportation.

YOUNG ITALY ("GIOVANE ITALIA"), a society of Italian republicans formed by Giuseppe Mazzini (q.v.) in 1831, whose aims were the emancipation of the Italian peninsula from the control of Austria, and the union of the various portions of the country under a republican rule. Its greatest activity was in 1834, when Mazzini led an unsuccessful invasion of Savoy. The influence of the society soon declined, but it was of service in arousing Italian patriotism and it formed the model for similar organizations elsewhere in Europe, such as Young France, Young Germany, etc.

YOUNG MEN'S CHRISTIAN ASSOCIATION. A Young Men's Christian Association is an organization composed of young men who are united together for the purpose of ministering to the spiritual, intellectual, social and physical needs of young men. Any young man of good moral character, regardless of race or creed, may become a member of this organization and enjoy its privileges; but only active members, who must be in communion with a Protestant evangelical church, can vote or hold office. Local associations are usually under the administration of a board of directors, which employs to carry on its work officers known as general secretaries, physical directors, boys' secretaries, etc. Local societies are independent and autonomous in their administration. Local societies are affiliated together into national and sometimes into international unions. These national unions are under the administration of a national committee. The national organizations are further united into a world's organization, having its headquarters at Geneva, Switzerland. The world's organization is administered by what is known as the Central International Committee of Young Men's Christian Associations, 3 Rue Général Dufour. The International Committee of the North American Young Men's Christian Associations is located at 347 Madison avenue, New York City. The chairman is Alfred E. Marling. The vice-chairman for home work is William Sloan and the vice-chairman for foreign work is William D. Murray. The general secretary is John R. Mott.

History.— The establishment of the Young Men's Christian Association was occasioned by the growth of the modern city. The city movement which has spread throughout the more industrial parts of the world created an environment which made necessary special efforts in behalf of young men. Without the rise of the city, the parlors, gymnasiums, reading-rooms, educational classes, Bible studies, religious meeting, this vast organization of over 1,000,000 young men throughout the world with its secretaries, directors, committees, costly buildings and mighty influence would never have been born.

The association movement was founded by a young man who came from the country to the city. It was founded primarily for commercial young men living away from home in cities. Without the spread of the city it would have remained a London institution, and never have become a world-wide organization. The city has become the dominant factor in modern life. Young men form the largest and most important element of the large army which is annually invading the city from the country. The proportion of young men in the city is much larger than in rural districts. In the city, the home and the church have a smaller place in the life of the average young man than in the country. The city is full of opportunities to gratify temptation. Contrasted with the country, where life is in the open air and activity is chiefly muscular, life in the city is indoors and far more full of nervous excitement. It should also be said that the city has brought young men together in large numbers, and so made possible an organization among themselves in their own behalf.

The history of the association falls into four periods: (I) The Founding of the Association, 1844–55; (II) The Development of the Association Ideal, 1855–78; (III) The Expansion of the Movement, 1879–1913; (IV) The Work During the World War, 1914–19.

Period I, 1844 to 1855. Founding of the Young Men's Christian Association.— The founder of the Young Men's Christian Association, George Williams, later Sir George Williams, who was born at Ashbury Farmhouse, near Dulverton, southern England, in 1821, grew into manhood at the time when the industrial revolution in England was attracting young men from the country to the town. He went to London in October 1841, and became a clerk in the dry goods establishment facing Saint Paul's churchyard, of which he was afterward the proprietor. At that time there were some 80 young men employed in the different departments of the business. Through Mr. Williams' efforts, a Young Men's Christian Association was organized, for the purpose of establishing religious services and Bible classes among the young men employed in various houses of business in London. This organization took effect on 6 June 1844. The name was suggested by Christopher Smith, George Williams' roommate. The constitution provided that the association should seek to promote the spiritual and mental improvement of young men engaged in the drapery trade, that its membership should be young men who gave decided evidence of conversion to God and that its management should be in the hands of a small board chosen from the membership. This movement rapidly assumed important proportions. Prayer meetings and Bible classes were soon established in 14 different business houses, and a missionary to young men was employed in January 1845. In 1848 apartments were rented, in which a library, reading-room, restaurant, social parlors and educational classes were provided; and young men who made no religious profession were invited, upon the payment of a small fee, to use

the American continent and a uniform basis adopted by the associations of all lands. The fundamental principles of the association began clearly to emerge. Although the movement was at first primarily religious and spiritual in character, the association was led to add secular agencies for ministering to the intellectual and social needs of young men. It recognized the principle that ministering to the needs of a man is one of the surest ways to promote his religious life; and on the other hand, that the Christian religion demands the development of all human powers and their use in the service of God. It is upon these two truths, the power of environment to mold character and the adaptation of the religion of Jesus Christ to redeem man in body, mind and spirit, that the Young Men's Christian Association rests its claim for a place among the agencies of the Church.

Period II, 1855 to 1878. Period of Development of the Association Ideal.— During the years from the Paris convention in 1855 to the Geneva convention in 1878, when a central executive committee for the associations of the world was established, with headquarters at Geneva, the Young Men's Christian Associations were gradually developing a world consciousness as an organization, and slowly evolving a method of work for ministering to the needs of young men. During this period, the American associations rose to the place of pre-eminence, and the type of association developed here has in later years spread throughout the world.

The six years preceding the Civil War were remarkable for two results in the American associations, the creation of the International Committee, with its work of supervision, and the great revival which stirred the entire country during the years 1857 and 1858. During these years, the central committee of the confederation was located respectively at Washington, Cincinnati, Buffalo and Philadelphia. This migratory plan was soon found to be a source of weakness, but much good was accomplished. Annual conventions were held, and information regarding the new movement was widely disseminated. Many new associations were founded; and at the outbreak of the war there were 240 associations in North America, with an estimated enrolment of 30,000 members.

In 1856 several members of the New York association established a union prayer-meeting, chiefly for men, at the Dutch Reformed Church, in Fulton street. This was carried on for nearly a year, and in the following September it was given over to Mr. J. C. Lamphier, the city missionary of the Dutch Reformed Church, with the understanding that it should be continued on a union basis. The committee of the association arranged to co-operate heartily in this meeting.

In the fall of 1857 came the financial panic which prostrated the business interests of the country. Large numbers of men began immediately to attend this noon prayer-meeting and, under the auspices of the New York association, many more union meetings were established in different parts of the city. Similar meetings were conducted by all the Young Men's Christian Associations throughout the country. It is estimated that over 300,000 persons were added to the evangelical churches of America as a result of this revival.

The years from 1861 to 1866 in America were overshadowed by the cloud of the Civil War. The financial depression and the distractions attending the outbreak of the war brought the association to the lowest point it ever reached. The Boston membership fell from 2,400 to 700. The New York City association, at the beginning of 1862, had but 151 members; it was burdened with a debt of $2,400, and its work had sadly declined. It is recorded that only 60 organizations survived the war; and yet, in the midst of this depression and apparent weakness, the association performed one of the most heroic tasks ever undertaken by a religious organization.

Through the influence of the association in New York, heartily seconded by those of Boston, Washington, Philadelphia, Chicago and other places, the United States Christian Commission was organized. This was the first organized attempt, on a large scale, to minister to both the spiritual and material needs of soldiers in time of war. This form of effort became later a well-organized feature of the associations. In the Spanish-American War and in the Boer War a service program for the welfare of the soldiers was carried on by the associations. The same effort was made with marked success by the associations of Japan among Japanese troops in the Russo-Japanese War. The association was the only agency with experience and resources prepared to render a similar social service to the Allied armies in the great World War. The plan of work of the United States Christian Commission was to send out delegates with supplies and needed comforts, who should spend some five or six weeks without remuneration, nursing the sick and wounded, distributing literature, conducting evangelistic and religious meetings, bearing messages from home, and in various ways encouraging and helping the soldiers. Over 5,000 of these delegates were sent to the front during the Civil War. The following table shows the vast efforts of this commission in raising money and supplies for the soldiers:

*Receipts by the United States Christian Commission.

	1862	1863	1864	1865 (4 mos.)	Total
Cash	$40,160	$358,200	$1,297,755	$828,357	$2,524,472
Supplies	191,096	558,637	1,584,992	1,432,298	3,766,623
Totals	$231,256	$916,837	$2,882,347	$2,260,655	$6,291,095

* Mem. 'United States Christian Commission,' p. 729.

This was an heroic service, and won for the association the admiration and confidence of the public. In the meantime, the New York City society had secured for its secretary Robert R. McBurney, and for its president William E. Dodge, Jr. It had on its board of directors Hon. Cephas Brainerd, who had been identified with its work from the beginning, and who had early perceived the true mission of the association. Mr. Dodge with his associates set about developing in New York a work specifically adapted to the needs of young men, and introduced a new era in association history. Mr. Dodge was in sympathy with the idea of a clean, home-like social resort for young men, and with the providing of opportunities for physical training. It was at his suggestion that the constitution of the New York City association was altered so as to provide for the erection of a gymnasium. Mr. Dodge was also influential in enlisting large gifts for the association. He was himself the largest donor to the first building.

The years from 1866 to 1870 mark the revival of the American work after the war. In June 1866 an international convention was called at Albany, which outlined a new policy for the associations. The plan of a migratory international committee was abandoned, and the headquarters were permanently established in New York City. Hon. Cephas Brainerd was, a year later, chosen chairman of this committee, a position which he held for 25 years. This convention announced the platform that the work of the association should be limited to young men, although it was some years before this became the actual practice. The convention established a day of prayer for young men in November, which has become a world-wide observance. It also arranged for the organizing of State committees, and the beginning of what is usually spoken of as State work. The great contribution of this convention, however, was the emphasis which it placed on the true field of the Young Men's Christian Association as distinctive work for young men. In his opening address, Mr. Brainerd said: "Our future progress rests upon an unswerving devotion to the primary objects and aims of this association — the social, mental, and religious improvement of young men. As organizations with these avowed objects, we challenge attention. As seeking these ends we are prominently before the world. Because of these things we are what we are. When we deviate from them, we trench upon ground assigned to others."

As yet there was no uniformity among the associations in America as to the conditions of membership. At the international convention held in Portland, in 1869, it was decided that only members of evangelical churches should vote or hold office in the association, and it was stated that:

> We hold those churches to be evangelical which maintaining the Holy Scriptures to be the only infallible rule of faith and practice, do believe in the Lord Jesus Christ (the only begotten son of the Father, King of Kings, and Lord of Lords, in whom dwelleth the fulness of the Godhead bodily, and who was made sin for us though knowing no sin, bearing our sins in His own body on the tree) as the only name under heaven given among men whereby we must be saved from everlasting punishment.

In the meantime, in New York City a determined effort was being made to erect a suitable building adapted to the needs of young men. In addition to the work already undertaken for the spiritual, intellectual and social improvement of young men, it was decided to add a gymnasium for physical training. After an earnest canvass for funds, and a most careful study of plans, the historic building on the corner of 23d street and Fourth avenue, which provided under one roof for the various phases of association activity, was erected. This building cost $487,000, and was opened to the public in November 1869. Here was developed the modern type of the diversified work for the cultivation of Christian manhood, which has become characteristic of the American associations, and which is spreading throughout the world.

A unique feature of this building, which has been copied in most association structures, was the central reception-room, or lobby, in which was the public office of the secretary, and through which every one must pass upon entering the building. From this reception-room opened the reading-room, the parlors, the amusement-room, the gymnasium, the library, the educational classrooms and the secretary's private office. This enabled the secretary in charge to control the various activities which were housed under one roof, and to keep in touch with the multitude of young men who took advantage of the privileges of the association.

The years from 1870 to 1878 in America may be characterized as a period of adaptation of the work of the association to the needs of young men, and the extension of this work to various classes of young men. It is an interesting fact that, as soon as the organization specialized its work and limited it to young men, it immediately found a large field for service. In 1872, at Cleveland, a branch association was founded for work among railroad men. This met with a hearty response from the men themselves. A secretary was employed, rooms were opened at the railway station of the Lake Shore and Michigan Southern road and an effort made to extend the work elsewhere. Similar societies were also organized at a number of the terminal points, and in the fall of 1875 the attention of Mr. Cornelius Vanderbilt was called to this work. Through his endorsement other railroad officials became interested in this movement. It was soon found that it was worth while for railroad corporations to provide the facilities and attractions of a Young Men's Christian Association for the comfort of their employees.

As early as 1858, at the State universities of Michigan and Virginia, student Young Men's Christian Associations had been organized. Early in the 70's, Mr. Robert Weidensall organized similar societies in a number of colleges. By 1876 there were 25 college associations, with about 2,500 members. Through the influence of Mr. Luther D. Wishard, a student at Princeton, representatives of all college associations were invited to the international convention held at Louisville, Ky., in 1877. This resulted in the inauguration of the intercollegiate movement as a department of the work of the international committee. An extended effort was also made during this period among German-speaking young men, and toward its close a work was inaugurated among colored young men.

One of the most important agencies developed during this time was the work of supervision. The international committee located in New York steadily grew in resources and influence. A number of the most prominent Christian business men of New York City and other parts of the country accepted positions of responsibility upon this committee. In 1868 Mr. Robert Weidensall became the first traveling secretary, being located in the West with headquarters at Omaha, afterward Chicago. He is still in the service of the committee. Mr. Weidensall has done much pioneer work, organizing State committees, and introducing many new phases of work for young men. In recent years he has particularly fostered what is known as county work for young men in rural districts. Mr. Richard C. Morse accepted a position with the International Committee in December 1869, first as editor of the *Association Monthly*, and in 1872 as executive secretary of the committee, in which position he continued until 1913, when he was succeeded by Dr. John R. Mott. Mr. Morse has been appointed consulting secretary.

At the close of this period, 1878, the American International Committee had in their employ eight traveling secretaries, and in addition to the general work, were supervising work for railroad men, college students, German-speaking young men and colored young men. The budget for 1878 showed an expenditure for supervision on the part of the International Committee of $16,875. The American associations at this time reported 141 employed officers. Of these, 100 were general secretaries, 21 assistants, 12 State and 8 international secretaries.

In other lands, while war, ecclesiastical conditions and general conservatism retarded the growth of the association, a marked development had taken place. Every three years conventions of the associations of all lands were held in different European cities. To these the American associations since 1872 have regularly sent representatives. During the early 70's, Mr. Moody made his evangelistic campaigns in the British Isles, and did a great deal to stimulate the work of the Young Men's Christian Association in securing money for buildings, in arousing spiritual zeal and in calling the attention of the Church to this important work. In 1878 some 40 representatives of the American associations attended the world's convention, which met at Geneva, Switzerland. Up to that time there had been no established headquarters for the world's work. General affairs had been administered from London through Mr. W. E. Shipton, the secretary of the London association. It was chiefly through the influence of the French and American delegates that the Geneva convention voted to organize the work of the associations in all lands under an advisory committee, which should have a quorum located at Geneva, Switzerland. Col. Charles Fermaud, an officer in the Swiss army, and a man with bright business prospects in Geneva, consented to give up his calling and accept the position of general secretary of this committee. By the year 1878, with the establishment of the world's committee, the Young Men's Christian Associations of the world may be said to have developed their ideal of work for young men.

Period III, 1878 to 1913. Period of Expansion.—Expansion has been the striking characteristic of the period from 1878 to 1913. The association ideal of a four-fold work for the whole man had been developed by the American associations under Robert R. McBurney of New York City. This ideal has been promoted throughout America under the supervision of the International Committee. The American type of work for young men in this period of expansion was now to be promoted throughout the world largely by the efforts of the American International Committee.

In North America the associations between 1878 and 1913 increased in membership six-fold, from 99,000 to nearly 600,000 members; in value of property 38-fold, from $2,300,000 to $88,300,000; the number of buildings 13-fold, from 56 to 770; the cost of current operation 36-fold, from $376,000 per year to $13,725,000.

The three factors which have most profoundly influenced the association movement, during this period, have been (1) the securing of property, (2) of trained secretaries and directors who give their whole time to this service, and (3) the development of State and International committees of supervision. The carrying on of an all-round work for young men — physical, social, intellectual and spiritual — demanded not only experienced and able men to conduct the work, but commodious and properly adapted structures in which it could be housed.

The "discoverer and demonstrator" of the secretaryship was Robert R. McBurney, who was secretary of the New York City association from 1862 until his death in 1898. Under his leadership, this office was developed and the number of employed men increased. Of all the agencies the association movement has brought forth, the most vital is the secretariate. To this may be attributed its permanence and continued power. There are now nearly 5,000 men devoting themselves to this service as a life work. Over twice this number were enlisted for war work among the Allied troops. The pre-eminence of the American associations is chiefly due to this policy of employing salaried officers. About five-sixths of the secretaries employed by the associations of all lands are in the United States and Canada.

Not only have men been employed for supervisory work, but since 1870 there has been an increasing demand for Christian young men to devote their lives to service in the association as physical directors. Seven hundred and fifty-eight such men are now employed. To the Christian physical director, the Young Men's Christian Association owes the development of the physical department, which aims not only to give young men physical training and rugged, vigorous bodily development, but also to develop character. This department has proved a great attraction to young men. In 1896 the Year Book reports 52,672 men as using the physical department of the association. In 1918 there were 242,000 enrolled in gymnasium classes, of whom 118,000 were boys. Much of the progress of this department has been due to the leadership of Dr. Luther Halsey Gulick, who became instructor of physical training at the Association Training School at Springfield

in 1886, in which position he continued until 1900. In 1888 he was also appointed secretary of the International Committee for the physical department, in which office he served until the spring of 1903. He was succeeded at the Springfield school by Dr. James H. McCurdy and on the International Committee by Dr. George J. Fisher. The Young Men's Christian Association is doing the most extensive work in physical training of any agency in the country. It is also interesting that more than 40 per cent of the physical directors in academies and colleges have been furnished by the association. The physical department has proved not only a means for physical well-being, which is much needed under modern city conditions, but also a means of leading young men into lives of personal purity.

In 1878 there were 8 international and 12 State secretaries and 94 secretaries in local associations. At the present time (1919) there are 704 county, State and international employed officers engaged in supervisory work, 30 instructors in the training colleges, 3,245 men serving city associations, 550 with railroad associations, 139 with student associations, 78 with associations for colored young men, 77 with army and navy associations and 113 in other forms of service. There are a total of 4,936 salaried officers employed by the associations of North America.

In 1885, at Springfield, Mass., a school was established for the training of general secretaries for the Young Men's Christian Association. The year following a physical department was added for the training of physical directors. This school at first offered a two-years' course of study, which was later extended to three years. In 1890 a similar school was established at Chicago. This institution also conducts a summer term at Lake Geneva, Wis. In 1902 a summer school was established at Silver Bay, Lake George, N. Y. These educational agencies seek to thoroughly train officers for the Young Men's Christian Association as a life work. About one-sixth of the officers of the association have received training at these institutions. The courses of study cover the Bible, Church history, psychology, sociology, religious pedagogy, physiology, anatomy, anthropometry, physical diagnosis, physiology of exercise, gymnastics, athletics, aquatics, history of the Young Men's Christian Association, methods of work among young men, etc. There are about 500 students enrolled in these two institutions in addition to those attending the summer institutes. The summer schools have attracted so many of the employed officers (over 1,500 in 1919) that six additional summer schools have been established in the South, the West and in Canada. The Southern associations have also established a training college with a two-year course at Nashville, Tenn. The first summer school was held at Lake Geneva, Wis., in 1884.

The building movement in America has developed with increasing momentum. In 1890 there were 205 buildings, valued at $8,350,000, in the United States and Canada; in 1900 there were 359; in 1902 there were 460. The number has now passed the 1,000 mark, valued with other real estate at $96,000,000. During the past year 27 association buildings have been erected. There is no greater testimony to the confidence of Christian philanthropists and business men in the Young Men's Christian Association and its work than the investment of large sums of money in association property. The type of architecture developed by the Young Men's Christian Association is of the club order, its buildings being homelike and social.

One of the striking developments of this period in the city work has been the growth of the educational classes. Immediately upon the erection of the building on the corner of 23d street and Fourth avenue in New York City, evening classes were begun in different subjects for young men. Similar classes were carried on in other cities, and by 1892 20,536 different men were under instruction. In 1892 George B. Hodge was appointed secretary for the educational department of the International Committee, and this work has been systematized and greatly developed. His successor is Mr. William Orr. International examinations are now held annually, in which large numbers of students take part. International certificates are accepted by more than 100 different colleges and institutions. An illustration of the growth of this department is seen in Boston, where the association in 1918 reported 3,843 different students, studying in its educational department. This association has a law school which has been given by the legislature a charter, granting the right to confer degrees. It has the Huntington Avenue school for boys who are preparing to enter college. It has schools of engineering and of certified accountancy. The Boston association has also recently incorporated "Northeastern College," of which the educational director, Frank P. Speare, is president. This college supervises branch work in the neighboring city associations of Massachusetts and Rhode Island. Nearly every association contains a reading-room, 700 report having libraries and many others are distributing stations for public libraries.

In 1918 the Year Book reports 82,000 students in the day and evening association schools. There were 327 secretaries and assistants supervising this work and 2,203 paid instructors who were giving part-time service.

The religious spirit of the association has been dominant from the beginning. All welfare work for young men — economic, physical or educational — is conceived of as an expression of the religious spirit and as contributing to a many-sided personality and a symmetrical Christian character. This distinguishes the association from boys' clubs, social settlements, boy scouts and many other agencies for the social betterment of young men. There has been a large conservative element in the association which has held theologically to traditional orthodox teaching. The association has, however, made remarkable progress in its distinctly religious work. This is now organized into a system with five features: (1) Religious meetings; (2) individual interviews; (3) classes in religious education; (4) social service; (5) missions. Religious meetings are chiefly held on Sunday afternoon. These were for many years almost exclusively of an evangelistic character but in recent years have in many cases become forums for the community where the great social, civic and religious problems of the day are discussed by prominent leaders from an ethical standpoint. At Springfield, Mass., under

the leadership of Kenneth Robbie, such a Sunday afternoon forum has been maintained for seven years with an attendance often reaching 4,000.

Mr. Fred B. Smith during this period was secretary of the religious department of the International Committe. Under his leadership general evangelistic campaigns for young men were promoted culminating in the Men and Religion Forward Movement of 1912 in 60 North American cities. In 1918 there were reported 1,061,000 auditors at theatre meetings, 2,273,000 auditors at shop meetings. These are held outside association buildings. In the buildings there were reported 2,276,000 auditors at men's meetings and 295,000 at boys' meetings. There were a total of 6,000,000 auditors at these various religious meetings. There were 32,500 decisions for the Christian life reported and 6,434 young men reported as uniting with churches.

In religious education the chief emphasis has been upon Bible classes, but there is an increasing diversity of program which is evolving into a department of religious education. In more progressive associations like the 23d street branch in New York City, there are classes in "Christianity and Modern Thought," led by the secretary, Burt B. Farnsworth, courses in Church history, life problems, sex hygiene and social service.

In spite of the depletion of attendance of young men at colleges and universities during the World War, most gratifying reports come from student associations. In 1917 there were 27,000 students in classes in religious education. These were chiefly in Bible classes, but nearly 3,000 were in mission study classes and 4,000 were in classes studying "North American Problems."

An important phase of the religious work of the association is the interest in foreign missions which it has aroused among young men. The student volunteer movement, which is an outgrowth of the student department, is the chief missionary agency in the colleges of this country. It annually secures a large number of students to volunteer for foreign missionary service. At one time as many as 4,000 students have been enrolled as volunteers in all colleges. In the men's colleges in 1917 the number was 1,237. More recently the effort has been broadened to include all religious callings, home as well as foreign. In 1917 there were reported 280 undergraduates as preparing for the secretaryship of the Y. M. C. A. and 3,066 for the ministry.

The latest period of association history has been marked by a great extension in the work for different classes of young men. In August 1895 the World's Student Christian Federation of under-graduates of all lands was established. This is now the largest organization among undergraduates in the world. In the United States and Canada the movement has been extended to professional schools, theological seminaries and other institutions of learning. There are now 791 college associations upon this continent, enrolling 51,117 student members. American student associations own buildings valued at $1,581,000. There are now 137 student secretaries devoting their whole time to this work.

The work for railroad men has become one of the most remarkable features of Christian endeavor. Railroad corporations which control three-fourths of the railroad mileage on this continent contribute from the corporation funds large amounts toward the current expenses of the railroad associations. There are 122 buildings, valued at $7,422,000, occupied by these associations, with a membership of 94,000 railroad men. There are 550 secretaries engaged in this department.

Since 1879 the International Committee has employed a secretary to develop the work among colored young men. The work among colored young men was greatly stimulated by the offer of Julius Rosenwald of Chicago, a wealthy business man of Jewish race, to give $25,000 toward the erection of a building for a colored Young Men's Christian Association to any community which would raise $75,000 additional. This offer was continued for a period of five years, during which some 12 colored association buildings were erected. There are now 150 associations of colored young men, with 17,600 members, with 77 employed officers, with property valued at $1,716,000. The secretary of the International Committee for this department is Jesse E. Moorland. There are to-day 86 Indian associations, with 815 members, under the direction of a traveling secretary, who is a native American Indian.

Largely as an outgrowth of the work for students in other lands, the American International Committee was invited by missionaries in India to inaugurate a work among young men in non-Christian lands. This work has always been carried on in subordination to the church and as a supplementary work where missions have already been developed. There are now 118 secretaries of the American International Committee in India, Ceylon, Japan, China, Brazil, and other foreign lands.

The policy on the foreign field is to develop self-governing and self-supporting local associations and national committees. In countries outside of the United States, Canada and Europe there are 292 associations with 58,231 members, occupying property valued at $700,000. In these associations there are 462 employed officers, four-fifths of whom are natives. In the promotion of this work in 1910 ex-President William Howard Taft invited a conference at the White House, attended by about 100 leading Christian laymen, which resulted in securing $2,000,000 for the foreign work.

Even before the Spanish War began steps had been taken to inaugurate a work among the seamen of the navy, and after the war a building was equipped for seamen at the Brooklyn navy yard. This department has developed rapidly, and at the present time there is an organized movement among the seamen of the navy which is full of promise. Through the munificence of Mrs. Helen Gould Shepard and Mrs. Russell Sage, an attractively equipped building has been erected for the Naval Association, near the navy yard in Brooklyn, at a cost of $1,100,000. Work is now being done at seven other home ports and also in the Philippine Islands. There were 77 secretaries in the army and navy associations of the United States at the outbreak of the war.

For many years the work of the associations

134 association buildings erected especially for men in industry at a cost of $4,717,000. In 1917 the companies contributed $417,000 toward current expenses and the employees paid an equal amount in membership fees.

The industrial revolution which attracted the young men to the city, and so created the basis for the Young Men's Christian Association, has to a large extent depleted the rural districts of young men. At the same time it still remains true that a majority of young men are found in the country. There are 8,000,000 young men in the country districts of the United States and Canada. For many years an effort was made to discover some method of carrying on association work among these men. What is known as county work has proved so successful that in 19 different States there are now county organizations, the most extensive work being carried on in Michigan, where 32 county secretaries are employed in 26 counties. The plan of work is a county committee, which employes a traveling secretary who will supervise and stimulate Christian work among the young men in the county, organizing Bible classes, men's meetings, in many cases establishing reading-rooms, social parlors, sometimes educational classes, and in some instances organizing clubs for athletics of various kinds. County conventions are held, deputation Sundays and a carefully systematized effort is made through the entire county. There are now 150 secretaries employed in county work.

Under Mr. Morse's leadership the staff of the International Committee had increased from two executive secretaries in 1869 to 93 on the home field and 175 on the foreign field in 1915. The budget of the committee had grown from $2,345 in 1869 to $354,000 for supervision of the home field and $433,000 for the foreign field. The North American type of association work for the whole man had largely through the influence of the International Committee spread to Europe and widely through the colleges and cities of Asia, Africa and South America.

Membership fees range from $2 to $25 per year in addition to receipts from dormitories, restaurants, educational classes and many other features. The income of the North American associations for the year ending 30 April 1917, exclusive of receipts from contributions and endowments, was $13,071,609 — this amount was paid by the young men. The receipts from contributions were $2,140,114 and from endowment $325,561. The accompanying illustration gives an idea of the growth of the organization.

Period IV, 1914 to 1919. The World War Period.— The leading spirit during this period has been Dr. John R. Mott, who was transferred in 1915 from the secretaryship of the foreign department to the general secretaryship of the International Committee.

The important features of the past five years have been (1) the great activity of the home work in the rural field, in industry and among boys; (2) the rapid development in the foreign field; (3) the great work for the prisoners of war, both in allied countries and in the Central empires; and (4) and surpassing all these the transcendent work for the armies of America, France, Italy and Russia carried on by the American associations and for British and Canadian troops carried on by the British and Canadian associations. The work for war prisoners was peculiarly the task of the American associations prior to the American declaration of war against Germany in April 1917. No other country was free to undertake this service. By May 1916 there were over 4,000,000 men in the prisoner-of-war camps of Europe (Report International Convention, 1916, page 91). These men were in enclosures containing from a few thousand to 40,000 persons, who were practically without occupation. Through the efforts of Dr. Mott and a number of American secretaries detailed from the foreign field, permission was secured from the various belligerent governments and a most beneficent service inaugurated for this vast body of prisoners. The policy was to erect in each camp an inexpensive hut or service building, organize a camp association, establish educational classes, athletics and games, furnish a reading room, supply writing material, inaugurate shows and entertainments and carry on religious meetings and Bible classes. In co-operation with the Red Cross, food kitchens were established and supplied, the sick men nursed and clothing and other necessaries provided. During the first 17 months of the war $300,000 was raised in the United States for this work and the following year $1,167,322 were raised and expended for work in Europe among both prisoners and soldiers. This Christian service to the prisoners saved men from starving, restored morale, awakened new hope and often educated men for a new sphere in civil life.

On the Mexican border in the summer of 1916 there were a total of 150,000 American troops called into service under conditions, not only full of discomforts and hardships, but full of menace to moral character. The Army and Navy Department was quick to respond to this need. Thirty-eight temporary buildings were erected. Tents were used at six additional points and special motor equipments devised with moving picture machines, graphophones and other features. There were 350 secretaries, clergymen and business men employed in this service. Free stationery was provided for the writing of 5,000,000 letters home. Recreational and educational facilities were promoted by trained leaders. For this work during eight months $308,000 was raised. At the entertainments there were present nearly 3,000,000 auditors; a well-planned religious program was carried out and over 13,000 soldiers decided to live the Christian life. The chairman of the Army and Navy Department of the International Committee was William Sloane of New York and the executive secretary John S. Tichenor. This work on the Mexican border prepared the way for the unsurpassed service among American troops during the World War — the climax of the work of the Young Men's Christian Associations. Upon the declaration of war in April 1917 the International Committee immediately offered the services of all the Young Men's Christian Associations of America to the government, and this offer was cordially accepted by President Wilson.

On 10 April Dr. Mott called a conference of association leaders to meet at Garden City, L. I. He outlined plans for the establishment of a National War Work Council of 100, which

should be appointed by the International Committee, carry on all work for the American soldiers and make reports to the International Committee. Dr. Mott asked that the associations raise $3,000,000 to sustain this work until 31 Dec. 1917.

The conference enthusiastically endorsed the plan proposed and devised methods to cooperate in securing the fund needed in 30 days. Two days later a meeting was held of the International Committee; the proposition was approved, the National War Work Council appointed and the first meeting called for 28 April. William Sloane became chairman, Cleveland H. Dodge, treasurer and Dr. John R. Mott, general secretary. George W. Perkins was made chairman of the finance committee; Lucien T. Warner, chairman of the committee on personnel and John Sherman Hoyt, chairman of the committee on activities.

It is well known how much vaster the American forces became by land, sea and air than was at first anticipated. The Young Men's Christian Association with heroic effort expanded its services to meet the crisis.

The advantages of this work to the comfort, the morals and the spirit of the troops was so great that requests came from the French government for a similar service to the French army. Later an urgent appeal was cheerfully responded to from both Russia and Italy. Under American leadership work for French troops was carried on at 1,350 *Foyers du soldat* and in Italy at 2,000 *case del soldato.* The British associations in the same manner did an extended work for the British soldiers in England and France. This effort was carried on under the leadership of the National Secretary, Sir Arthur Yapp, who was knighted by King George as a recognition of this service.

The Canadian associations under their own National Council ministered in an equally thorough manner to the Canadian army; about 700,000 Canadians were enlisted, of whom about 400,000 were sent overseas. This work overseas was in charge of Lieut.-Col. Gerald W. Birks of Montreal and in France under the direction of Maj. Ernest M. Best. This service began in Canada in August 1914 and was carried on during the entire war. The Young Men's Christian Association of Canada was made a part of the military establishment and the secretaries became officers in much the same manner as chaplains. The first secretary to give up his life was Capt. Harry Whiteman of Quebec, who died from overwork in northern France. The first secretary to receive the British Military Cross was Capt. Frank Guy Armitage.

The work for the American army was divided into two sections, (1) the home camps; and (2) the work overseas. Overseas, E. C. Carter, who had been national secretary of India, was placed in charge at Paris. The first problem of the War Work Council was to secure funds. To these appeals the citizens of America responded with great liberality. The first request for $3,000,000 met with contributions amounting to $5,000,000. So vast did the work become that this amount subscribed in May 1917 was exhausted by October and it became necessary to borrow large sums. A second campaign, of which A. H. Whitford, general secretary at Buffalo, was director, was inaugurated in November 1917; an appeal was made for $35,000,000 to carry on the war work at home and abroad for one year. This appeal met with a response of $54,000,000. In the meantime other agencies beside the Young Men's Christian Association had become enlisted in a large way. As the association had been the pioneer since the Civil War in this form of effort it furnishes the standards and most of the methods undertaken by other agencies. In accordance with the desire of the government Commission on Soldier's Activities appointed by the War Department, the various agencies, exclusive of the Red Cross, which were engaged in promoting welfare work for the army and navy combined their budgets for a joint campaign for November 1918. The budgets were approved by the commission and a total of $170,000,000 was asked for. Of this sum the allotment for the Red Triangle work was 58 per cent. Dr. John R. Mott was made director-general of this campaign and Mr. C. S. Ward, the originator of the short term campaign method for securing funds, was associated with him. In spite of the excitement incident to the signing of the armistice during the campaign the effort was successful, the subscriptions amounting to $203,000,000 — the largest voluntary offering for religious welfare work ever made.

It is impossible to portray here the enormous work done for the troops. Some facts about the activities carried on on the home side of the Atlantic for the year ending 30 April 1919 are as follows (Year Book 1919): Different men served, 4,000,000; number of employed officers, 4,600; funds expended, $30,000,000; number of units, 1,171; attendance at entertainments, 27,000,000; participants in athletic sports, 2,500,000; lectures given, 39,044; attendance at educational classes, 5,404,000; at Bible classes, 2,085,000; at religious meetings, 14,181,000; decisions for the Christian life, 195,414. A most effective service was also rendered by the local associations throughout the country to soldiers on liberty leave, and a carefully organized work for the men in transit on the troop trains. The problem of personnel was most difficult; only men beyond military age could be used and the proportion of those interviewed who were qualified and were physically fit to stand the arduous work required was less than one in 10. Short term intensive courses of training covering one month were established at the Springfield and Chicago colleges in June 1917 and later at Silver Bay and Blue Ridge. In several of the large camps similar courses were conducted, the largest at San Antonio, Tex. Approximately 4,000 students received the training of the short-term courses. For the men who were to go overseas, an additional course of one week was conducted by the War Work Council at Columbia University.

The most remarkable work of all was for the Expeditionary Forces in France. Here over 3,000 miles from its base of supplies, the association undertook to serve 2,000,000 men scattered through France and later western Germany. How to interest the soldiers in their leisure time back of the front and how to serve them to the uttermost in the war area was the problem of the staff at headquarters. The association did not shrink from any task to which it was called, even when asked to carry

on the army store (canteen) in order to release effective men for fighting. When Mr. Carter reported to General Pershing that there were complaints about the canteen, General Pershing replied, "The Y. M. C. A. are not in this war to avoid criticism, but to render as much service as possible to the men, under the limitations under which we are all working in this war."

In the canteen alone the "Y" in France from June 1918 to April 1919 handled 2,000,000,000 cigarettes, 32,000,000 bars of chocolate, 18,000,000 cans of smoking tobacco, 50,000,000 cigars, 60,000,000 cans of jam, 20,000,000 packages of chewing gum and 10,000,000 packages of candy. These were only a few of the items handled. (Report on Activities by George W. Perkins). Because of the difficulty in buying supplies, the "Y" operated in France 20 biscuit factories, 13 chocolate factories, three candy factories and three jam factories. All of this canteen service was undertaken unexpectedly and carried on in addition to the regular work for the men — physical, social, intellectual and religious.

The "Y" was operating in March 1919 in France 587 buildings erected by the association, 596 leased buildings and 782 tents and army buildings. "These buildings were used as centres where the men could congregate, write letters, read magazines, books and papers, play games, visit and feel relieved of a certain amount of the restraint necessary to army life." (Perkins). In them were conducted concerts, moving picture shows, all sorts of entertainments and religious services. The buildings were open to all welfare organizations. Religious services were conducted by Protestants, Catholics, Jews and all other religious organizations, regardless of creeds.

A large number of well-trained athletes led in athletic games and in boxing and wrestling. Athletic supplies were given without charge to the soldiers. These included 575,000 baseballs, 140,000 bats, 65,000 fielders' gloves, 85,000 indoor baseballs and 75,000 footballs. This work was in charge of Dr. James H. McCurdy of Springfield. The entertainments of various kinds were multitudinous and often of the highest quality. A number of theatres were operated in different parts of France. In March 1919 there were 95 American troupes, playing in different parts of France, which gave 4,350 performances in a single month.

In one year 220 French entertainers and 702 American were employed. From August 1917 to April 1919 in France 90,000 "movie" shows were given to audiences aggregating 50,000,000 (Perkins).

Writing home was a great opportunity to the men; "400,000,000 sheets of writing paper with the necessary envelopes and 16,000,000 postal cards were distributed to the soldiers." At 25 leave areas holiday opportunities, including athletics and entertainments, and sight seeing were freely provided; also large hotels and recreation grounds at various centres in France, England, Italy and later in Germany.

An educational system was developed under the leadership of 600 college professors and school teachers. This was expanded rapidly after the fighting ceased. Up to April 1919, remittances from 323,432 soldiers were sent home through the association, amounting to $19,542,000.

Many prominent clergymen in addition to "Y" secretaries and business men led in the religious work. The religious program was carried on at all the centres. Instruction in sex-hygiene was given by a staff of 40 lecturers under the direction of Dr. Frank N. Seerley of Springfield, Mass. The general religious work was under the supervision of President Henry Churchill King of Oberlin.

A devoted body of workers enrolling a total 11,229 was sent overseas for this service. In April 1919 there were 5,693 men and 2,657 women on the association staff in France. A most self-sacrificing service was rendered by these workers, not only in the training areas but on every front in exposed positions in the face of danger and hardships. There were 215 casualties among association workers although they were non-combatants. Nine workers were killed by shell-fire while on duty, 29 were seriously gassed or wounded and 31 died in the service from exposure and over-work. (Mott, *Association Men*, January 1919).

Whether the Young Men's Christian Association has reached its final form no one would be bold enough to affirm. It is remarkable that it should have grouped together such a variety of agencies upon the simple platform of young men advancing the kingdom of Christ among young men. Through the four periods of its history the association has evolved into an institution with an enlarged ideal, closely akin to that of the Christian university. It is still animated by the evangelistic, spiritual purpose of the original band of young men who rallied around George Williams 75 years ago. But, while keeping uppermost this ideal, it has endeavored to do, in a popular way, for the multitudes of young men of our cities what the Christian university, in a more scholarly way, is doing for the young men who are to enter the professions. There is every evidence that the association has only begun its career of usefulness, and that in the future it will become a manifold more important factor than in the past.

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YOUNG PEOPLE'S CHRISTIAN ENDEAVOR UNION OF THE UNITED BRETHREN IN CHRIST, founded 5 June 1890. It is a union of all forms of young people's societies within the church, uniting them for the purpose of denominational direction. It was originally named the Young People's Christian Union. Its official organ, *The Watchword*, was founded in 1893. With its junior societies the organization numbers over

2,000 societies and more than 85,000 members. It contributes about $10,000 annually to missions.

YOUNG PEOPLE'S SOCIETY OF CHRISTIAN ENDEAVOR. See CHRISTIAN ENDEAVOR, YOUNG PEOPLE'S SOCIETY OF.

YOUNG PRETENDER, The, a title applied to Charles Edward Stuart, son of the Pretender. He was defeated by the Duke of Cumberland at Culloden, 16 April 1746.

YOUNG'S TRAVELS. In 1767 Arthur Young began that series of journeys, or farming tours, which were the basis for his graphic sketches of rural England, Ireland and France. His first trip included Southern England and Wales, and an account of his observations appeared in 1768 under the title 'A Six Weeks' Tour through the Southern Counties of England and Wales.' Following this first survey, he traveled through Northern and Eastern England from 1768–70; this resulted in 'A Six Months' Tour through the North of England' (4 vols., 1770), and 'The Farmer's Tour through the East of England' (2 vols., 1771). These books contain a wealth of information relative to the social, economic and political conditions in England during the latter half of the 18th century. Young was a most determined and indefatigable tourist. He visited practically every county in England, inspected farms, described farm methods and implements used. He met all classes of people, from peasantry to nobility. His information concerning rural conditions, such as rentals, produce, livestock, and means of transportation and communication in the kingdom, was founded on actual examination. Two features especially roused Young's indignation. In the first place, he saw on every side vast tracts of land uncultivated and in waste; even all the cultivated land, with rare exceptions, was placed under the same unvarying rotation. Everywhere there seemed to be inability to put the land to its best use. Then, too, Young had no patience with poor roads. In 1770, on the Preston-Wagan turnpike, he measured ruts "four feet deep and floating with mud, only from a wet summer"; and again he says, "I know not in the whole range of language terms sufficiently expressive to describe this infernal road. Let me most seriously caution all travelers who may accidentally propose to travel this terrible country, to avoid it as they would the devil; for a thousand to one, they break their necks or their limbs by overthrows or breakings down." His description of other highways is given in an equally lucid manner. Young's works on England were very favorably received, being translated into most of the European languages by 1792.

In 1776 he made a tour of Ireland, publishing his 'Tour in Ireland' in 1780. He remained in Ireland three years and during part of this time was occupied in managing an estate in County Cork. The result of his stay, nevertheless, was a survey of the country which, for accuracy, fullness of detail, and acuteness of observation, is invaluable to this day. He stated clearly and exposed unsparingly the causes which retarded the progress of Ireland. He strongly urged the repeal of the penal laws which oppressed the Catholics; he condemned the restrictions imposed by Great Britain on the commerce of Ireland, and also the perpetual interference of the Irish Parliament with industry. The work abounds in elaborate statistics and tables of prices; as Marie Edgeworth well says, it is "the first faithful portrait of the inhabitants."

'Travels in France' (2 vols., 1792) is probably the best known of Young's writings. He made his first visit to France in 1787 largely as the result of an invitation from the French nobleman, the Duke of Laincourt. He traversed France in every direction just before and during the first movements of the French Revolution, and he paints not only a picture of French agriculture but describes institutional conditions in France at that critical period. This work, while of great intrinsic merit in itself, has been greatly enhanced and widely circulated because of the fact that it is one of the most valuable sources to which historians have turned for a comprehensive statement of the actual pre-revolutionary situation in France. He visited one out-of-the-way region after another, recording in diary fashion his impressions vividly and candidly. From the first page to the last he sets forth the abject wretchedness of the majority of the people and the stagnant conditions of trade and commerce caused by inefficient government. His earliest journey took him in a southwesterly direction through the Orleannais and the Berri, where for the first time he met with the *métayage*, which he described as "a miserable system that perpetuates poverty and excludes instruction"; and further, he describes the fields as "scenes of pitiable management; and the houses of misery." Throughout the entire work the *métayage*, or farming on half profits, is condemned in the strongest terms. Poitou is described as "an unimproved, poor and ugly country." Young said it seemed greatly in need of "communication, demand and activity of all kinds." Journeying on to Languedoc, he found the land in a high state of cultivation and the peasants happy; he concluded his journey by a visit to Landes on his way to Bordeaux. Young's second journey took him through Brittany and Anjou, which he described as a land "possessing nothing but privilege and poverty" — while Maine and Anjou — "have the appearances of deserts." His third tour of France covered a much greater area. He started with Champagne, traveled through Alsace-Lorraine, made his way through to Jura, Burgundy, the Bourbonnais, Auvergne; took a glimpse of the Rhone valley, visited Avignon and Compte de Nice. His impressions on this journey are not so full, and this fact is probably due to the extent of territory covered and the local disturbances. Young found that half, if not two-thirds, of the land was already in the hands of small proprietors. Peasants supplied the industry and carried out what improvements were made, thus illustrating his famous phrase, "The magic of property turns sand to gold." The great *seigneurs* did nothing; they received the quit rents and enforced *tailles* and *corvées* and all the other oppressive incidents of feudal tenure. He drew a severe indictment against the French nobility, and even approved of the forceful seizure of the waste land by the

French peasantry. He severely censured the higher classes for their neglect of the soil,—"Oh, if I were a Legislator of France for a day," he exclaimed at the sight of estates left waste and only to be used for game purposes, "I would make such great lords skip again." Young saw the commencement of violence in the rural districts and his sympathies were largely on the side of the classes suffering from excesses of the Revolution, although he was never a thorough political follower of the Revolutionists. Tocqueville recognized his work as a first-hand authority on the rural conditions of the country on the eve of the Revolution.

Young was a highly sensitive, enthusiastic, impulsive, affectionate man and a great lover of nature. His 'Travels' are deservedly famous and have earned a wide reputation and have been of great influence. No better summary of the chief characteristics of Young's writings can be given than to quote the words of R. E. Prothero in 'English Farming, Past and Present.' 'His careless ease of style, his racy, forcible English, his gift of happy phrases, his quick observation, his wealth of miscellaneous material, make him the first of English agricultural writers. . . . His tours, with their fresh word-pictures, their gossip, their personal incidents, and even their irrelevancies, have the charm of private diaries.' His varied agricultural writings, thus characterized above, were by far the most important agency in disseminating the information concerning those advanced methods introduced into England by Jethro Tull, Lord Townshend and Robert Bakewell and which constituted the agricultural revolution in 18th century England.

Consult the works mentioned. 'Travels in France' were translated in 1793–94 by Soulés (new version by M. Lesage, with an introduction by M. De Lavergne, 1836). An interesting review of the latter publication, under the title of 'Arthur Young et la France de 1789,' will be found in M. Baudrillarts' 'Publicistes modernes' (2d ed., 1873). Consult also Bethan-Edwards, Matilda B., 'Autobiography of Arthur Young' (1898); Prothero, R. E., 'English Farming, Past and Present' (1912; pp. 154, 184, 195–206, 286, 313, 470).

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YOUNG WOMEN'S CHRISTIAN ASSOCIATION. The Young Women's Christian associations in the cities, the colleges and the rural communities of the United States are organized into a national association called the Young Womens Christian Association of the United States of America. The National Board is the executive body of this association, chosen to carry out the policies adopted by the voting delegates at the national conventions, which are the regular business meetings of the National Association. The 30 National Board members and the 15 auxiliary members are elected by the conventions; the 11 non-resident members are chosen each by her own field committee to represent that particular section of the country. The National Board appoints a committee of 40 or more members in each field to have the responsibility for organizing and aiding in the development of the association in that field. Headquarters of these field committees are in Philadelphia, Richmond, Cincinnati, Chicago, Saint Louis, Dallas, Minneapolis, Denver, Seattle, San Francisco and New York City.

The name Young Women's Christian Association has been known in the United States since 1866. When the first organization bearing this title was formed in Boston, it had the same objective, the same evangelical church membership basis, the same combination of volunteers and employed working forces as obtain to-day. The first student association, Normal University, Illinois, dates from 1873. Without tracing history, in this connection it should be said that each united with other associations subsequently formed. The student and many city associations on the evangelical basis (according to which only associations in which the right to vote was held by members of evangelical churches were received into affiliation), united in electing the American Committee with headquarters in Chicago; the Women's and Young Women's Christian Association of many other large cities holding various forms of charter united in the International Board.

In December 1906, after 18 months of constructive negotiation, the present national movement was formed of all local, city and student associations affiliated with either body which wished to come in on their then existing basis, with the understanding that all associations in the future should have the evangelical church basis. Very few failed to avail themselves of this privilege. One hundred and thirty-two associations were represented by 392 delegates in that first convention, which voted policies for immediate action and elected the National Board. This board at once elected as president, Miss Grace H. Dodge, who had been chairman of the Joint Commission which had effected the union. Six years later, members of this board and a few other friends gave site and funds for the erection of the present headquarters building at Lexington avenue and 52d street, New York City.

The scheme of organization is as follows: The resident members of the National Board are assigned to committee work under eight departments—field work, department of method, foreign, secretarial, conventions and conferences, publication, finance and office. Each department has an employed executive and other staff secretaries. The office department applies scientific management to the work of all the other departments. The publication department edits and publishes *The Association Monthly*, technical leaflets, Bible study texts; handles printing of the other departments; fills orders for books. The finance department makes the budget and secures the money. In 1915 the conference department conducted 15 conferences with 4,592 delegates, two camp councils for high school girls and six for industrial members, attended by 1,358 girls. The secretarial department conducts a graduate training school in New York City; preparatory training centres in different parts of the country prior to this year's course; and a summer school with graduate courses for physical directors, house secretaries and lunch

room directors. The number enrolled in the whole training system for 1915–16 was 141. A bureau for placing association secretaries is also part of the work of this department. The foreign department co-operates with the World's Young Women's Christian Association in sending American secretaries, 38 in number, to India, China, Japan, South America and Turkey. The field work department correlates the work of the 11 field committees before mentioned with the work at headquarters.

If the field work department of the National Board can be called colloquially the clearing house, the *department of method* can be called the laboratory of the National Board. By visiting local associations, sharing in their work, studying other organizations of women and other Christian and social movements, a great body of information is gathered. This study and planning cover the needs and possibilities of all young women, their conditions and general environment in city, student, country and large town communities, with special emphasis at the present time upon the adolescent girls, the foreign-born young woman, the girls in business and professional life, the girls in industry, the girl at study, the girl in domestic service, the girl at home.

There are 994 associations with a total membership of 360,865, distributed as follows: (1) There are 255 city associations with a membership of 292,181. City associations are found in every State of the Union except Vermont, Wyoming and Nevada, and in Washington, D. C., and in Honolulu. There are a few unaffiliated city associations. In 1915, 137 associations received regular or transient guests; 90 associations have travelers' aid departments and are prepared to carry that responsibility until a national Travelers' Aid Society is formed. These associations (so far as reporting) have 193 gymnasiums where 65,693 members are enrolled; 18,341 students in domestic art and 8,623 in domestic science classes (1914); and 795 certificates of the National Board and American Red Cross were granted for first aid. Of the religious work and missionary department it can be said that it is to-day the most characteristic feature of the movement.

(2) There are 18 county associations in 13 States with a membership of 7,215. Supplementary to these organized associations in reaching country girls are the eight week clubs. From 101 different colleges last summer, specially prepared student members of the associations returned to their homes in villages and open country and organized 244 groups of 3,863 girls.

(3) There are 721 student associations with 61,509 members, of which 1,288 members are in Indian schools and 2,327 members are in colored schools. The National Board has four commissions at work — The Commission on Character Standards, on Social Morality, on Thrift and Efficiency and on Household Employment.

YOUNGHUSBAND, Sir George John, English soldier; b. 9 July 1859. He entered the army 1878, and was promoted successively lieutenant 1880, captain in 1889, major in 1896 and lieutenant-colonel in 1900. He served in the Afghan War in 1878–80, in the Sudan in 1885, on the northwestern Indian frontier in 1886, and in the Burmese expedition of 1886–87. In 1895 he was a member of the Chitral relief force, and in 1898 was detailed to accompany the American forces in the Spanish-American War and the subsequent campaign against the Philippine insurgents. He fought in the second Boer War in South Africa (1899–1902), and was severely wounded. Subsequently he was assigned to the Indian staff corps, and was awarded a medal and clasp for his services with the Mohmand Expedition to the Northwestern frontier of India. He was knighted in 1913, and served in the European War in 1914–17, attaining rank as major-general. From 1917 he was Keeper of the Jewel House in the Tower of London. Author of 'Eighteen Hundred Miles in a Burmese Tat' (1888); 'The Queen's Commission' (1891); 'Relief of Chitral' (1895); 'The Story of the Guides' (1908); 'A Soldier's Memories' (1917); 'The Tower from Within' (1918), etc.

YOUNGSTOWN, Ohio, a modern industrial city of 140,000 population, centre of the second largest steel district in the United States, sixth city in population and fourth in financial and industrial importance in Ohio, county-seat of Mahoning County, on the direct line between Pittsburgh and Cleveland, 67 miles from each and five miles from the Pennsylvania line; covers a rectangle containing 25.15 square miles, divided diagonally by Mahoning River which flows southeasterly and joins the Ohio 35 miles away. The river divides the city into north and south sides, the latter first settled. A viaduct built in 1899 has given the "South Side" such impetus that it is now a thickly populated residence district. The main business street, Federal, parallels the river for three miles, crossing at the Public Square, Wick avenue which connects the north and south sides and southward is called Market street. The public square at Youngstown is 285 feet above Lake Erie, and 858 feet above sea-level.

Municipal Service and Improvements.— The city has 320 miles of streets of which 158 miles are paved. There are 180 miles of sewers, discharging into the Mahoning River. A disposal plant is now projected. In 1917 the city built an impounding reservoir of 1,700 acres on the river at Milton, 17 miles away. The capacity is 10,000,000,000 gallons; cost $1,250,000. Beside producing an immediate expansion in the industries of the whole valley, the reservoir is becoming one of the most attractive play spots in the State. The domestic water supply is municipally owned and was established in 1872. A new pumping station, 1916, has 31,500,000 gallons daily capacity, the water from Mahoning River, passing through mechanical sand filter, with alum and lime, through 206 miles of cast-iron mains. There are 2,091 fire hydrants and three standpipes. The valuation of the water system is $2,477,000 and the annual cost of the pumping plant $56,460. The city as a whole is very healthy. The birth rate is 34.18 and the average death rate 14.51. In addition to the health officer, there is a secretary, chemist, bacteriologist, six sanitary inspectors, inspectors of plumbing and foods. The police department has 154 men, 12 mounted, with the three platoon system established in 1899, 80

patrol boxes, 8 motor vehicles; expenditures $158,732. The fire department was completely motorized in 1913 and now has three steam engines, five triple pumpers, nine hose wagons, 10 substations, 108 men, and expends $151,859 annually. The service-at-cost, or "Tayler," system of street-car operation became effective by action of the council December 1918, and by this 59 miles of the track and property of the Mahoning and Shenango Railway Company is supervised by the city under a commissioner ($6,000) appointed by the mayor for a four-year term. There are 119 miles of suburban street railways centring in Youngstown, besides a 23-mile line of the Youngstown and Southern, to Leetonia. The Mahoning River is spanned by seven bridges, of which the Market Street viaduct is 1,600 feet long. Division Street bridge is to be replaced by a high level bridge, 3,400 feet, crossing the river and 44 railroad tracks. There are two telephone companies — the automatic with 11,000 instruments, the Bell with 15,500 instruments. Electric lighting is general (14,000 meters) but natural gas from West Virginia is used for domestic fuel.

Parks.— Mill Creek Park, situated in the southwestern section of the city, consisting of 485 acres, is the largest and one of the most beautiful natural parks in the country, largely the result of the 30 years' labor of Volney Rogers, a local attorney. The park is three miles long, winding through a natural gorge. It has 14 miles of drives and seven miles of walks, three bathing beaches, two large artificial lakes, three water falls, an old mill and dancing pavilion. A canoe house at $15,000 and bathing house at $50,000 will be erected soon. This park is managed by a commission, consisting of three men appointed by the judge of the County Common Pleas Court, with power to levy a maintenance tax on the "township" of Youngstown. Up to the present time it has cost the taxpayers of the city $700,000 and is valued at $1,500,000. Other parks of the city are under the management of a commission appointed by the mayor. They receive their funds from the regular tax levy. Wick Park, northern part of the city, has 34 acres, one and one-half miles of paved drives; Lincoln Park, eastern part of city, 60 acres; Crandall Park, northern part of city, 50 acres; South Side Park, southern part of city, 22 acres; Pine Hollow Park, southeastern section of city, 22 acres. Most of these have playgrounds and bathing pools.

Chief Buildings.— The most notable building in Youngstown and one of the most beautiful in the country is the gallery of The Butler Art Institute, erected by Jos. G. Butler, Jr., at a cost of $500,000 and opened in 1919. It is of marble, the simple, chaste design having been made by McKim, Mead and White. The Mahoning County Court House built in 1911, costing $1,000,000, is a classic building containing excellent mural paintings by E. H. Blashfield and C. Y. Turner. In 1915 the city erected a handsome six-story municipal building at a cost of $340,000. The Reuben McMillan Free Library building (named in honor of a former superintendent of schools) is a handsome Indiana Stone structure, planned with unusual success and built in 1911 at a cost of $155,000, of which $50,000 was contributed by Andrew Carnegie. The Y.M.C.A. building was opened in 1915, having cost $375,000. It has 137 dormitory rooms. The Y.W.C.A. building was opened in 1912, and an annex given by Robert Bentley in 1918, the total cost having been $250,000. A post-office building, erected in 1898 (cost, $75,000) and an addition in 1910 (cost, $100,000) have for several years been totally inadequate so that temporary additions have been resorted to. Important business buildings include the Dollar Savings, Commercial National and Mahoning bank buildings, the Wick, Stambaugh and Home Savings and Loan buildings and others under construction. Three of the foregoing are 13 stories high. Rayen and South High schools offer interesting contrast, the first of Ionic style opened in 1866 built during the Civil War, but with two recent additions; the latter a buff brick building costing $350,000 opened 1911. Other buildings of note are the Youngstown and Saint Elizabeth's hospitals, Masonic Temple, Saint Columbia's, Saint Edward's and Saint John's churches.

Commerce.— The Pennsylvania and Ohio Canal, built in 1839, stimulated mining of large deposits of Brier Hill block-coal, which long formed a principal part of Youngstown's commerce and warranted building a railroad to Cleveland, opened in 1856. There are now the Erie, Pittsburgh and Lake Erie, Pennsylvania, Baltimore and Ohio, New York Central, and Lake Erie and Eastern roads, four stations, and 57 passenger trains daily. Bonds for $800,000 were issued by the city in 1915 to eliminate the Erie grade crossings and land has been condemned for a union passenger station costing $5,000,000 to be erected by the Erie Railroad. One mile east of the city the railroads converge into what is reputed the heaviest traffic point in the United States. Of this tonnage the larger part is raw and finished products of the steel works which line the Mahoning River for 21 miles. Some relief is promised in the proposed Lake Erie and Ohio River barge canal, surveys for which have been completed.

Steel Industries.— The growth and importance of the city has been due to the iron and steel industry. As early as 1805 a blast furnace was built with a capacity of two tons of pig iron per day. The second blast furnace in the United States to use raw block coal, and a rolling mill for making bar iron were both built here in 1846. In 1856 shipments of Lake Superior ores brought much new smelting industry to Youngstown, and blast furnaces sprang up rapidly during the next generation, using lake ore and Pennsylvania coal and coke as the native supplies became exhausted. Rolling mills were built between 1880 and 1890 and the first general steel mill in the valley was erected in 1895 by the Ohio Steel Company, now the "Ohio Works" of the Carnegie Steel Company. The close proximity of limestone, one of the raw materials for steel making, has been a great aid in the industry. Four limestone quarries, nearby, have a combined output of 5,000,000 tons a year, employ over 2,000 people, and besides steel material supply the largest paving-brick plant in the world, as well as agricultural lime and other by-products.

During 1917 the American Iron and Steel Institute recognized the growing importance of Youngstown by creating the Youngstown District, which includes works in the Mahoning,

Shenango and Beaver valleys and adjacent territory, and produces one-sixth of the pig iron and one-eighth of all steel made in the United States. In 1918 there were in the district 51 blast furnaces producing 6,250,611 tons of pig iron, 47 steel works and rolling mills producing 2,843,455 tons of Bessemer, 4,462,061 of open hearth and 20,680 of other castings; wire rods, 225,306; plates and sheets, 1,133,712; merchant bars, 791,691; skelp, 701,376; other rolled products, 913,913 tons; a total of rolled products, 3,765,998. In addition there are coke-oven plants at three of the Youngstown works, with a total of 533 Koppers ovens. From the by-products large quantities of tar, benzol, ammonium sulphate, toluol, xylol and solvent naphthas are made locally, while other by-products are shipped for manufacture elsewhere.

Subsidiary and Other Industries.— Subsidiary to the steel industry are many manufactures which use steel or its by-products. Among these are steel furniture and structural parts; steel sash and pressed-steel buildings; waterproofing, asbesteos, cement, shingles, blast furnace equipment, boilers, bridges, cars, cranes, engines, forgings, machine-shop products, stoves and washed metal. Independent of the steel industry are manufactories of automobile trucks, brass, cement, flour, gas mantles, mill work, electric bulbs, leather, powder, wagons and rubber.

Finances and Banking.— The assessed valuation of the city is $215,260,960; tax rate, $15; bonded debt, $5,502,356. The State tax law makes bonding practically the only method for public improvements with the result that of a total city revenue of $2,766,666, the annual interest on bonds and debts is $1,778,882, while $987,784 is spent on operating expenses. The school board levies its own tax, expending $1,180,324 on public schools. The city owns property valued at $17,717,110. Post-office receipts are $457,190. The banking business is conducted by five banks and three building and loan associations, which have a combined capital of $5,400,000 and total deposits of $70,000,000. The savings deposits alone amount to $41,428,036, an unusual average for the population. The First National (the third oldest national bank in the United States) and Dollar Bank has 61,000 depositors, and the largest retail foreign exchange department in the country, with 10,000 depositors and $7,000,000 deposits. No bank failures have occurred in Youngstown.

Churches.— Of the 110 churches, chapels and missions 64 are English-speaking congregations; 74 are Protestant, with a membership of about 20,000 and Protestant constituency of approximately 50,000. These represent every major denomination. The Federated churches have a central office and a paid secretary to promote church activities. More than $100,000 a year is contributed by these church members for missionary and benevolent enterprises. The contributions for local work total above $200,000. There are five orthodox and one reformed Jewish Synagogues, with flourishing congregations, the Jewish population being approximately 10,000, who are active in the business, social and intellectual progress of the city. The Catholic church plays an important part in the life of the city. The estimated Catholic population is 65,000. There are 22 churches, six English, three Greek Catholic, two Polish, two Italian, two Slovak, one each of German, Rumanian, Croatian, Magyar, Lithuanian and Syrian.

Benevolent and Social Service.— Youngstown has a complete and carefully developed plan for organized social service, centring in its Community Corporation (not for profit) organized in 1919, which annually raises in one campaign the funds necessary to maintain 28 affiliated organizations. Of the $1,200,000 total budget $400,000 is contributed annually by 15,000 citizens through the Community Corporation. Nursing service is furnished by City Hospital (250 beds), Saint Elizabeth Hospital (200 beds), Visiting Nurse Association, Anti-Tuberculosis League, Community Social Hygiene Clinic and Florence Crittenton Home Association. Bonds for $500,000 have been issued by the city to erect a contagious hospital. Relief for needy families is given by the Community Service Society, Municipal Lodging House, Salvation Army, Rescue Mission, Saint Vincent de Paul Society and the United Jewish Charities. The welfare of children is promoted by the Baby Welfare Committee, Christ Mission Settlement, Day Nursery, Children's Service Bureau, Free Kindergarten Association, Fresh Air Camp and Joint Committee on Boys' and Girls' Work. Recreation, education, moral and civic training are afforded through activities of the Boy Scout Association (1,000 members), Y. M. C. A. (4,000 members), Y. W. C. A. (3,000 members), Playground Association, Nielson House, Colored Community Centre and the Booker T. Washington Settlement. Other organizations are the Youngstown Humane Society, Old Ladies' Home, Children's Home, Welfare Association for the Blind and Social Service Committee for the Blind, and the Mennonite Mission Settlement. Important industrial housing projects have been carried out, one company having erected 650 homes at an investment of $2,750,000.

Fraternal Orders.— The fraternal orders in Youngstown include Masonic (three Blue Lodges), Odd Fellows, Elks, Knights of Columbus, Moose, etc. The Chamber of Commerce has 1,050 members, the Rotary Club 130 members.

Education.— Youngstown's schools stand high among those of the nation, due largely to the devotion and ability which has characterized superintendents and teachers since the beginning. Among these was Reuben McMillan (1820–98) who with two short intermissions was superintendent from 1853–86. There are now 49 public school buildings in the city, valued at $2,820,000, on land valued at $550,000, which with equipment represent a total value of $3,482,000. There are two high schools, Rayen with a notable history dating back to the will of Judge William Rayen and opened in 1806, now with 38 teachers and 930 pupils; and South with 45 teachers and 1,208 pupils; 43 elementary schools, with 489 teachers and 18,273 pupils — a grand total of 565 teachers and 20,411 pupils. There are six kindergartens in addition to five others operated by the Kindergarten Association. The social centres regularly maintained at 12 schoolhouses and 13 public playgrounds on school property are effective and largely patronized. Schools are maintained also by the Catholic, Lutheran and other churches. The Catholic Church maintains 12 schools, with 80 teachers and 3,679 pupils. Yale School, estab-

lished in 1895, is a private school of 150 pupils. Large classes in varied subjects are conducted by the Y. M. C. A., Y. W. C. A., and other organizations. To supplement the schools the Public Library system is supported by taxation ($31,000 — including $6,000 from School Board), and under direction of Reuben McMillan Free Library Association of open membership. It has collections totalling 85,000 volumes, a staff of 20 assistants and circulates 310,000 volumes per year from its central building and 45 distributing points, most of which are in schoolhouses.

Newspapers.— The city is fortunate in its high class newspapers — both evening — *Telegram* (Rep.) established in 1851, and *Vindicator* (Dem.) established in 1862, with Sunday edition. Weekly papers in Italian, Hungarian, Rumanian, Greek, Slovak are widely read among the adult foreigners in the Mahoning and Shenango valleys.

Government.— Every two years the people elect a mayor; president of council; one councilman from each of the seven wards and three councilmen-at-large; solicitor, auditor, treasurer. The city clerk is appointed by the council. A director of public service and director of public safety are appointed by the mayor for a term of two years, and they with the mayor form the Board of Control which awards contracts for public work. Under the department of public service are the city engineer and superintendent of waterworks. Under the public safety department are the chief of police, fire chief, building inspector, electrical inspector and charities agent. The chiefs of police and fire are appointed by the mayor. A judge of the civil and criminal branches of Municipal Court are elected by the voters for two and four years. The Sinking Fund Trustees have charge of and provide for the payment of all bonds issued, for interest maturing thereon and the payment of all judgments final against the corporation. The Sinking Fund is now $509,745.54.

Population.— The population increased from 8,075 in 1870 to 44,885 in 1900, and 79,066 in 1910. It is now estimated at 140,000. The people of foreign birth or descent comprise the larger part of this number. According to the 1910 census there were 6,000 Germans, 5,500 Hungarians, 3,600 Italians and 1,700 Russians. The English, Irish, Welsh and Canadians totaled 5,600. Approximate estimates of foreign population now in Youngstown show Italians, 12,000; Slovaks, 12,000; Hungarians, 8,000; Croatians-Serbians, 5,000; Polish, 4,500; Rumanians, 4,000; Greeks, 3,000; Russians, 1,500; Spanish, 500; Syrians, Armenians, Turks, 250 each. Beside five newspapers these people have many social, educational and benefit organizations and take an increasingly valuable part in the city's progress.

History.— The township was named for John Young, one of the first settlers, who bought a tract from the Connecticut Land Company in 1796. David Tod, afterward "war governor," operated the first coal mines and led in establishing the canal and first railroad. Sturdy foreign elements attracted later by manual industries have combined with the descendants of early residents, largely from New England, and others, to form an enterprising, industrious, upright and patriotic community, which during 1917–18 sent 7,000 men (Mahoning County) to war, purchased over $50,000,000 government bonds and gave more than $3,000,000 to war work.

JOSEPH L. WHEELER,
Librarian, Youngstown Public Library.

YPRES, ē'pr (Flemish, *Yperen*), Belgium, a town in the province of West Flanders, in a plain, on both sides of the Yperlée, 28 miles south-southwest of Bruges, 53 miles by rail. Ypres formerly was one of the most important manufacturing towns of Flanders, and in the 14th century had 200,000 inhabitants and employed 4,000 looms. Its manufacturing prosperity had long departed prior to the European War, 1914–18, but a striking monument remained in its cloth-hall (Les Halles), an immense building of the 13th and 14th centuries, in the form of an irregular trapezium, surmounted by a square tower or belfry. One of its wings was used as the town-house, and other parts were occupied by different public establishments and concert-rooms. The Gothic cathedral of Saint Martin, dating from the 13th century, was one of the most remarkable religious edifices in Belgium. The chief manufactures were cotton and lace. The population numbered 19,000. Ypres was made by Louis XIV in 1688 one of the strongest fortresses of the Low Countries, and in the great European wars seldom escaped a siege or bombardment. Jansen (q.v.) was bishop of Ypres, and was buried in the cathedral of Saint Martin. During the European War the town was reduced to ruins. Its location on the most hotly contested "debatable land" on the western front, made it the scene of many a grim struggle between the German and British forces, and three great pitched battles being fought over the vicinity. Here the British troops barred the way to the Channel ports. The first battle of Ypres began 14 Oct. 1914, the second on 9 Nov. 1915, and the third on 31 July 1916.

In March 1919 the Belgian government intimated their desire of making Canada a grant of land in the city of Ypres for the erection of a memorial museum and shrine to the brave Canadian soldiers who in the defense of liberty had made the supreme sacrifice on the battlefields of the famous Ypres saliem. It was also suggested not to rebuild the city but to leave its ruins standing as a lasting monument to unjustifiable and ruthless German aggression. For an account of the Ypres battles see WAR, EUROPEAN — MILITARY OPERATIONS ON THE WESTERN FRONT.

YPSILANTI, ip-sĭ-lăn'tĭ, a distinguished Fanariot family descended from the Comneni and of prominence as defenders of Greek liberties. Its most conspicuous members are: ALEXANDER: b. Constantinople 1725; d. 1805; hospodar of Wallachia 1774–82, and again in 1796–98, and of Moldavia 1784–92. He propounded a scheme for the fusion of the Greek and Turkish people, but having incurred the suspicion of the Porte, was executed. CONSTANTINOS, his son: b. Constantinople 1760; d. Kiev, Russia, 28 July 1816. He early planned the freedom of Greece, but his scheme was prematurely discovered, and he fled to Vienna. Pardoned by the sultan, he was hospodar of Moldavia 1799–1805. He then went to Russia, but returned to Bucharest with 20,000 men, in the hope of freeing Greece. The peace of Tilsit interrupting his plans, he returned to Russia.

ALEXANDER, eldest son of the preceding: b. Constantinople, 12 Dec. 1792; d. Vienna, 31 Jan. 1828. He went with his father to Russia and, joining the Russian army, served with distinction in various campaigns. In 1820 he became head of the secret association known as Hetæria, whose aim was the independence of Greece, and in March 1821 entered Moldavia and raised the standard of revolt among the Rumanians. He was defeated by the Turks at Dragaschen, near Galatz, 19 June 1821, fled to Austria and was imprisoned six years at Munkacs, Hungary. DIMITRIOS, brother of the preceding: b. Constantinople, 25 Dec. 1793; d. Nauplia, 16 Aug. 1832. After serving in the Russian army, in 1821 he joined the Greek patriots in the Morea and played a brilliant part in the struggle. But though a brave and successful general, as his victory at Tripolitza and his defense of Argos show, his influence was constantly undermined by the "native" party, who never forgot that he was a Fanariot, and, therefore, a foreigner in part. In 1827, however, he was made commander-in-chief of the Greek army but the ungenerous course adopted toward him by the government of Capo d'Istria compelled him to resign 1 Jan. 1830, and he then withdrew from public affairs. GREGORY, brother of the preceding: d. 1835. He was the founder of a princely family now living near Brünn. NICOLAS, brother of the preceding: b. 1796. He wrote a volume of 'Mémoirs,' which gives considerable information concerning events leading to the insurrection of 1820.

YPSILANTI, Mich., city in Washtenaw County, on the Huron River and on the Lake Shore and Michigan Southern and the Michigan Central railroads, 30 miles west of Detroit and eight miles southeast of Ann Arbor. It is on both sides of the river, which furnishes a large amount of water power. In 1807 there was an Indian trading post on the site of the present city. In 1824 it was laid out as a town, became a village in 1832 and was chartered as a city in 1858. It has considerable manufacturing interests. In 1900 (government census) the total capitalization of the manufacturing establishments in the city was $1,200,000; the value of the annual products was $1,318,793. The chief manufactures are flour, paper, dairy products, underwear, agricultural implements, iron castings, pressed steel, hosiery, automatic parts, sash, door and blinds, tags and labels, pumps, cement and foundry and machine-shop products. The city is the commercial centre of a rich surrounding country. It contains nine churches and the Michigan State Normal College, a high school established in 1849, a business college, public elementary schools, kindergartens and public and school libraries. The two banks have a combined capital of $675,000, and, in 1919, had deposits amounting to $2,500,000. The city owns and operates the electric-light plant, the waterworks and gas plant. The government is administered under a charter of 1898, and is vested in a mayor, who holds office one year, and a common council of 10 members. Pop. 7,500.

YREKA, wī-rē'ka, Cal., city, county-seat of Siskiyou County, on the Yreka Creek and on the Yreka Railroad, about 275 miles north of San Francisco. It is in an agricultural and lumbering region, in which considerable attention is given to fruit cultivation and stock-raising. There are large stock yards, a lumber mill and fruit-packing houses. The city has three banks with a combined capital of $210,000 and a county high school. Pop. about 1,390.

YRIARTE, ē-rē-är'tā, **Charles Émile**, French journalist, artist and author: b. Paris, 5 Dec. 1832; d. there, 10 April 1898. He studied architecture as a pupil of Constant Defeux, became inspector of imperial asylums, and after this post was abolished, went on the Spanish expedition to Morocco in 1859 as correspondent and artist for the *Monde Illustré*, and in 1860 on Garibaldi's campaign in Sicily in the same capacity. From 1864 to 1870 he was editor-in-chief of the *Monde Illustré*. In 1881 he was made inspector of fine arts and in 1889 member of the superior council of fine arts. He wrote for the *Figaro* and for *La Vie Parisienne* over the pseudonym "Marquis de Villemer." Among his numerous volumes of various character are 'Portraits Parisiens' (1865); 'Gaya, sa vie et son œuvre' (1867); 'Les Tableaux de la Guerre' (1870); 'Le puritain' (1875); 'Venise' (1877); 'Autour du Concile' (1887); and several works on the Italian Renaissance, such as 'Florence' (1880); 'Francois de Rimini' (1882); 'Matteo Civitali, sa Vie et son Œuvre' (1885); 'Autour des Borgia' (1890) and 'Maso di Bartolommeo dit Masaccio' (1894).

YRIARTE, or IRIARTE, Juan de, Spanish linguist: b. Orotava, island of Teneriffe, 15 Dec. 1702; d. Madrid, 23 Aug. 1771. In 1714 he was sent to school at Paris and afterward he studied English in London and jurisprudence in Madrid, where he presently obtained a post in the royal library. In 1732 he became chief librarian and in 1742 translator for the ministry of foreign affairs. He published an important 'Codices græci manuscripti' (1769) and wrote many Latin and Spanish epigrams and proverbs. Latin poems, etc., included in his 'Obras Sueltas' (4 vols., 1774).

YRIARTE, or IRIARTE, Tomas de, Spanish dramatist: b. Orotava, island of Teneriffe, 18 Sept. 1750; d. Madrid, 17 Sept. 1791. He began to write in boyhood and in 1770 published his comedy, 'Hacer que hacermos,' under the pseudonym, "Tirso Ymareta." In 1870 he published a didactic poem, 'La musica,' and in 1782 'Fabulas literarias,' considered the best fables in the Spanish language. He also wrote the first regular comedies in Spanish, the best being 'The Spoiled Child' and 'The Ill-Bred Young Lady' (1788), and published Spanish translations of French plays, Horace's 'Ars Poetica' (1777), and four books of the Æneid.' In 1771 he succeeded his uncle, Juan de Yriarte (q.v.), as royal librarian.

YSAYE, ē-sī-yē, **Eugene**, Belgian violinist: b. Liége, Belgium, 16 July 1858. He studied at the Liége Conservatory and subsequently with Wieniawski and Vieuxtemps at Brussels. He made many successful European concert tours and in 1886-98 he was professor in the Royal Conservatory of Brussels. He originated a new school of violin playing, embracing features of the German, the French and the Belgian schools. He is considered one of the leading violinists of the world and is gifted

with marvelous powers of interpretation. He visited London in 1889 and established there as well as in the principal cities of the Continent a high reputation as a conductor and soloist. He first visited the United States in 1894 and toured the country repeatedly thereafter, becoming in 1918 conductor of the Cincinnati Orchestra. His compositions include several violin concertos, a piano concerto, a program symphony and a 'Suite Wallonne.'

YSLETA, ĕ-slā'tą, Tex., city in El Paso County, on the Rio Grande and on the Texas and Pacific and the Southern Pacific railroads, 12 miles southeast of El Paso. It is in a fertile agricultural region, the productive Rio Grande Valley, in which fruit and grains grow in abundance. It was founded in 1682 after the uprising of 1680, its residents being the Tigeux Pueblo Indians of the village of the same name in New Mexico visited by Coronado in 1540. They were later settled here by Governor Otermin, retaining the name of their village in New Mexico. The city claims to be the oldest in the State. Several of the descendants of the Pueblos are residents of the city. Population is more than 2,000; about one-third are citizens of the United States and nearly all the others are Mexicans and Indians.

YSSEL, ī'sĕl, or **IJSSEL,** Netherlands, the name of several rivers, chief of which are: (1) the Nieuw Yssel, one of the principal arms of the Rhine, which leaves that river below Arnheim, flows northeast for 16 miles to Doesburg, where it receives the Oude Yssel from Westphalia, then northeast, north and northwest, through Gelderland and Overyssel, past Zutphen and Deventer, receiving the Borkel and Schip-Beek, emptying at Kampen by many arms into the Zuyder Zee about 40 miles northeast of Amsterdam, and forming a constantly widening delta. It is one of the five main arms of the Rhine, is 320 feet broad at Zutphen, 764 at Kampen, and 90 miles in length, all of which is navigable. (2) The Neder Yssel, an arm of the Leck, which leaves that stream at Vianen, flows west through Utrecht, at Oudewater enters southern Holland and flows southwest past Gouda to join the Maas above Rotterdam, forming at its mouth the island of Ysselmonde. Length, 30 miles.

YTTERBIUM, a rare chemical element belonging to the Yttrium group. Discovered by Marignac in 1878 in the mineral gadolinite, it was separated into two elements named neoytterbium and lutecium by G. Urbain in 1907, and the same result was announced in 1908 by E. A. von Welsbach, who named the elements aldebaranium and cassiopeium. There was some discussion in regard to priority of discovery. Also found in other minerals occurring in Siberia, Scandinavia and Greenland. Symbol, Yb; atomic weight, 173. Its oxide Yb_2O_3 forms colorless salts with sulphuric acid, etc.

YTTRIALITE, a native silicate chiefly of thorium and the yttrium metals. It occurs in Llano County, Tex., in grayish-olive-green masses, associated with gadolinite and other minerals which have been mined as a source of the rare earths.

YTTRIUM, a rare chemical element discovered 1794 by Gadolin in the mineral gadolinite from Ytterby. It is always found in combination, some of the minerals containing it being gadolinite, xenotime, euxenite, yttrotantalite and polycrase. It is usually separated from the mineral by use of sulphuric acid or aqua regia. The element is obtained by heating the chloride with metallic potassium, by electrolysis of a molten mixture of the chloride and sodium chloride, or by heating the oxide with magnesium. It is a grayish-black, lustrous, metallic powder that burns in the air to the oxide Y_2O_3; soluble in dilute acids; symbol Y; atomic weight 89; valence 3. It forms a great many compounds closely resembling aluminium, but unlike that element forms no alums.

YUAN SHIH-KAI, Chinese soldier and statesman: b. Hsiang Ching, province of Honan; d. Peking, 6 June 1916. Descended from a family long active in the service of the state, Yuan was destined from the beginning of his career to become a leader in military, foreign and domestic affairs. Yuan Chi-san, his grandfather, achieved distinction in suppressing the Taiping rebellion (q.v.) and died (1864) as imperial commissioner and provincial commander-in-chief. Yuan qualified for a bachelor's degree and immediately attached himself to the (then despised) military profession. At the age of 20 he was appointed aide-de-camp to General Wu Chang-ching, then commanding the Chinese forces in eastern Santung. When the rebellion broke out in Korea (July 1882) Li Hung Chang, then the helmsman of China's ship of state, sent an expeditionary force, to which Yuan was attached, to the assistance of the emperor and quelled the uprising. Yuan in 1884 was given command of the Chinese garrison in Korea and the following year was appointed Imperial Resident. For the next nine years he was the de facto ruler, ably assisted by Sir J. McLeavy Brown. Yuan soon demonstrated his uncompromising attitude and autocratic methods, which involved him in many difficulties with the Japanese at Seoul. The Tonghak Rebellion (1893), the well-organized movement of the Nationalist party, followed by the sinking of the *Kowshing,* first proved China's military weakness. Protected by British blue jackets Yuan escaped to the coast. After temporary peace Yuan was restored, Li Hung Chang sent 5,000 troops to Yuan and ordered them to be trained in the Western fashion. This marked the beginning of China's modern army. Yuan ruled this small force with a rod of iron, but the men were slow to accept subordination and Yuan could not instill the necessary spirit of devotion in his troops. After the *coup d'état* of 1898 and the subsequent resumption of power by the Empress Dowager, the military prowess and reputation of Yuan became an important factor. He always remained a close friend of the empress, who was able to maintain the ruling hand until her death, with the constant assistance of Yuan, by this time well versed in all important affairs of government. When at the death of the Empress Dowager Tzu Hsi (1908), Kuang Hsu came into power, he fulfilled an old grudge and caused Yuan's humiliating retirement, for it had been rumored that this close friend of the empress silently acquiesced in a plot to overthrow the state, in which Yuan's blood-brother, Jung Lu, was the dominating factor. During the Boxer uprising (1900) the military experience of Yuan

became necessary and he was reinstated. Assisting the different viceroys in keeping the trouble confined to the immediate vicinity of Tien-tsin, at the same time lending valuable aid to the allied forces then in China. As Viceroy of Ghihli, November 1901, he was welcomed by the natives and foreigners as the best guarantee of restoration of order, and in this office he at once instituted educational and administrative reforms. His statesmanship was of a high order; he could always be trusted, and so with his appointment as administrative head of the foreign office at Peking (September 1907) and member of the Grand Council, the foreign diplomats welcomed Yuan as a statesman well liked and respected. At this period China was in the throes of continual unrest, and lacking trained military leaders, was compelled to recall Yuan (October 1911); he was appointed president of the Council of Ministers on November 1, and Prime Minister two weeks later, with full power to meet conditions as he found them. His rise was rapid. The subjects in the south clamored for a republican form of government.

While the Manchu Tartar autocracy which had ruled the "Celestial Empire" since 1643, strove to withstand the inevitable, Yuan, ambitious to become the supreme ruler, wavered between the 'Old Buddha' of the Tartars and the reform movement; fully realizing his ability to continue the actual domination of China whether it were termed republic or monarchy, he consented to be proclaimed provisional President of the republic of China (15 Feb. 1912). He was finally elected President 6 Oct. 1913, and immediately announced that China undertook to observe all treaties and obligations incurred by the Manchu regimen. He immediately abolished the Democratic opposition party, deprived members of their seats and suspended Parliament, and appointed an Administration Council until it could be reconstituted. The provisional constitution was completed in the spring of 1914, giving Yuan extensive powers, thus smoothing the way for his complete direct control of the empire. In November 1915 most of the provinces having voted for a return to monarchy, Yuan refused to ascend the throne as emperor; then changed his views and fixed the coronation for 9 Feb. 1916, and again abandoned the proposed idea of a monarchy. The provinces in the south again revolted, declaring that Yuan had forfeited his right by acceptance of the throne and proclaimed the vice-president, General Li Yuan-hung, as President of the new republic, but he was not generally recognized. Upon the death of Yuan the appointment of General Li Yuan-hung became certain, and he stepped into office 7 June 1916.

YUBA, yoo'bä, a river in California formed by the junction of three rivers, North, Middle and South, which have their sources in the Sierra Nevada. The Yuba enters the Feather River just below Yuba City. In its upper course it has many picturesque gorges and several cascades.

YUBA CITY, Cal., **town, county-seat** of Sutter County, on the Feather River, near the mouth of the Yuba River, and on the Southern Pacific Railroad, about 40 miles north of Sacramento. It is in a fertile agricultural region, in which fruits are among the important productions. The industries are chiefly connected with farm products. The town has one bank. Farmers' Co-operative Union of Sutter County, with a capital of $50,000. Pop. 1,200.

YUCATAN, yoo'ka-tan, Mexico, the most southeasterly and in respect to its ancient history one of the most interesting states of the republic. It is situated between 17° 40′ and 21° 35′ north latitude, and between 8° 39′ and 12° 12′ east longitude, meridian of Mexico. Bounded on the north by the Gulf of Mexico; on the east by Quintana Roo; on the south by Quintana Roo and Campeche, and on the west by the state of Campeche. Area, 15,939 square miles. Principal cities and towns: Merida (the capital) (q.v.), Progreso, Peto, Ticul, Uxmal and Izamal. Principal products: aguardiente, henequen, corn, honey, woods not reported; fruits, the principal ones being oranges, aguacates, watermelons, bananas, limes and lemons. Henequen or sisal hemp has become the principal crop. It finds a ready market in the United States. In 1900 a portion of the state was formed into the territory of Quintana Roo. Pop. 347,781.

YUCATAN, a peninsula in the southeast extremity of Mexico, projecting north by east to within 120 miles of the western end of Cuba. The peninsula comprises the Mexican states of Campeche and Yucatan and the territory of Quintana Roo, British Honduras and a portion of the republic of Guatemala. The surface is largely a table-land. The climate is hot, with deficient rainfall, but is not unhealthful, except for periodical visits of yellow fever. The soil is calcareous and porous; and little is seen of the ancient fertility which must have characterized this region when it was the seat of a flourishing civilization, with populous cities of great size and splendor. Only a small portion of the country is under tillage, and the general appearance is that of a wilderness. Vastly different was the scene at the time of the Spanish conquest 1527–47, "as revealed by the innumerable remains of towns, cities, temples, palaces and other public buildings dotted over the plateau, especially round the now desolate north and northeast shore of the peninsula." The vast ruins are the mysterious monumental remains of the Maya nation, whom the Spaniards found here, and whose descendants constitute five-sixths of the present population. There is no evidence for the great antiquity formerly assigned to the ruined structures in Yucatan; yet they are considered to antedate the southward Toltec migration — some of the cities having been forgotten ruins at the time of the Spanish conquest. Pop. about 400,000.

YUCATAN, Antiquities of. See MAYA; MAYAPÁN.

YUCCA, the name of a genus of shrubs with clustered ensiform leaves, belonging to the *Liliaceæ*, but also employed as a common name to designate the plants belonging to the entire botanical family of yuccas. This includes not only the genus Yucca but several other genera, as *Samuella*, *Clistoyucca*, *Hesperalæ*, etc. The species are chiefly found in the United States and Mexico, though some of them are distributed to many portions of the world. The best known species in the United States is *Yucca filamentosa*, or Adam's needle, which is

the White River, Sixty-Mile Creek and Forty-Mile Creek. It enters Alaska in about 65° N., and continues its northwestern course until the Arctic Circle is reached, when at the abandoned Fort Yukon it is joined on the right by the Porcupine River, bends suddenly, almost at right angles, and thenceforward has a general southwestern trend to its mouth.

The chief Alaskan tributaries of the Yukon are the Kozukuk on the right bank, and the Birch and Tanana on the left bank. Its whole course of 1,260 miles through Alaska is navigable by stern-wheel steamers, and beyond to Dawson in Canada; since the discovery of gold throughout the region in 1897 a regular summer service is maintained; the first impracticable obstruction to navigation is at the Grand Cañon, 1,866 miles from the mouth. In its lower course the Yukon is a broad, muddy stream flowing mostly through a marshy plain and for nearly nine months of the year, from October to June, frozen over; its upper course is through the grand scenery of narrow mountain valleys and rocky gorges. The Yukon is the largest American river flowing into the Pacific; it is the 17th river of the world as to length, the seventh of the Western hemisphere, the fifth of the North American continent and the third in the United States. This last assertion is based on its whole length of 2,300 miles, however, but taking only that portion which is in the United States, or Alaska, 1,260; it is the fifth river of our country, the Mississippi, Missouri, Arkansas and Ohio rivers being longer. There are but four rivers in the world with a greater capacity, the Amazon, the Mississippi, the Missouri and the Saint Lawrence.

YUKON. The Yukon territory is the most northwesterly of the political divisions of the Dominion of Canada. It embraces a large, roughly triangular area of country, measuring about 207,000 square miles, bounded on the south by British Columbia, on the west by Alaska, on the north by the Arctic Ocean and on the northeast by the series of mountain ranges separating the Yukon and Mackenzie basins. The population in 1911 was about 8,512, of which over 3,000 were Indians.

Topography.— The territory includes a mountainous belt on the northeast consisting of the Selwyn, Ogilvie and Peel River ranges of mountains, all of which are usually classed in the Rocky Mountain System, and the great Saint Elias range on the southwest. A number of peaks in the latter range, such as Mount Saint Elias and Mount Logan, exceed 18,000 feet in height. The central part of the territory is a broken upland known as the Yukon plateau, a great tract of rolling country deeply trenched in all directions by the wide valleys of the present and preglacial drainage system. Toward the Arctic Ocean the plateau is replaced by a plain sloping easily down to sea-level.

The greater part of the Yukon territory is drained by the Yukon River, with a total length of 2,300 miles, the fifth largest river on the North American continent and one of the great rivers of the world. The Yukon is formed by the junction of the Lewes and Pelly, the former drawing most of its waters from the Coast Range and the latter from the mountains of the Rocky Mountain System. Other large tributaries of the upper Yukon are White River, a swift, turbid stream heading in the glaciers of the Saint Elias Range, and the Stewart and Porcupine rivers, both of which enter it from the east. River steamers navigate the Yukon River throughout its whole length and also ascend the Lewes up to Whitehorse rapids, a total distance from tide-water of about 2,000 miles. The Pelly, Stewart and other tributaries are also navigable for some hundreds of miles above their junctions with the main stream.

Fauna and Flora.— The valley flats and the lower slopes of the hills and ridges throughout the territory are more or less thickly forested, while the uplands are bare. In the southern part of the territory the forest ceases at an elevation of 4,000 feet above the sea. Going northward the tree line descends gradually, and at the Arctic circle has an elevation of less than 2,000 feet above the sea. The principal forest trees are the white and black spruces (*Picea alba* and *P. nigra*), the aspen (*Populus tremuloides*), the balsam poplar (*Populus balsamifera*), the balsam fir (*Abies subalpina*), the black pine (*Pinus Murrayana*), and the birch (*Betula papyrifera*).

The larger animals of the district include the black and brown bear, the woodland and barren land caribou, the moose, at least two species of mountain sheep, the mountain goat, the timber wolf, the red fox and the wolverine, lynx and martin.

Climate.— The climate is severe. The winter season lasts from about the first November until April. The rivers are usually frozen by the first of November and remain frozen until May, while the lakes are seldom free from ice before the first of June. During the winter season thaws are infrequent and the temperature usually ranges from zero to 40° F. below. Occasional dips to 60° F. below and one to 68.50° F. below have been recorded. The low temperatures are usually accompained by a dry atmosphere and do not occasion much hardship. The summer season, lasting from the middle of May to the middle of September, is exceedingly pleasant, as the long clear days are never oppressively hot and the nights are always cool. The rainfall is light, the annual precipitation amounting to about 15 inches.

History.— The history of the Yukon territory dates back only to the year 1840. In that year Robert Campbell, a fur trader in the employ of the Hudson Bay Company, crossed from the Liard, a tributary of the Mackenzie, and discovered and named the Pelly, one of the main branches of the Yukon. In 1843 the same explorer descended the Pelly to its junction with the Lewes and was thus the first trader to reach the upper Yukon. In 1846 J. Bell, also in the employ of the Hudson Bay Company, descended the Porcupine to the Yukon, and in the following year Fort Yukon was built at the confluence of the two streams. In 1849 Fort Selkirk was established at the junction of the Lewes and the Pelly. It was raided and burnt by the Coast Indians in 1852 and was never rebuilt. Fort Yukon was occupied until 1869, when its site was proved to be in Alaskan territory and it was abandoned, and a new fort was built at the upper ramparts of the Porcupine. In 1850 Campbell descended the Yukon from Fort Selkirk to Fort Yukon and proved its identity with the Kwikhpak, the name by which the lower portion of the river was known to the Russians.

The fur traders were followed, after an interval of some years, by the prospector. The first gold seeker entered the country by the Chilkoot pass, through the Coast Range, in 1873. In 1881, bar-mining began on the Big Salmon River, and discoveries of productive bars on the Lewes, Pelly and Stewart soon followed. The first discovery of *coarse* gold was made in 1886 on Forty-mile River and was followed by important finds on streams flowing into Sixty-mile River. The Sixty-mile streams were actively worked until the announcement, in 1896, of the discovery of astonishingly rich creeks in the Klondike district drew most of the miners away. In 1897–98 a stream of 30,000 adventurers, including people of all trades and callings, poured into the country, all heading for the Klondike.

The discovery of the Klondike gold fields completely changed conditions in the hitherto unorganized and almost unknown Yukon territory. The town of Dawson was built at the confluence of the Yukon and Klondike rivers, and soon superseded Forty-mile as the chief commercial centre. A local administration, with courts of justice and other organizations necessary to government, was quickly established. The demand for better transportation was met by the construction of a railway from tide-water at the head of Lynn Canal to the foot of the Whitehorse rapids on the Lewes River from which point communication with Dawson is maintained by a large fleet of well-equipped river steamers. Telegraphic communication was also established with the outside world and roads were constructed up the valleys of most of the producing creeks.

Government.— The territory is governed, at present, by a commissioner appointed by the Federal government at Ottawa, assisted by an elective council of 10 members.

Industries.— Placer Mining.— The development of the territory has depended so far almost entirely on placer mining. The rich Klondike creeks have been worked continuously since 1897, and have yielded gold to the value of $170,304,000 up to the end of 1917. The yearly production reached its maximum in 1900, when it amounted to $22,275,000. Since that date production has been marked by a generally progressive decline; the yield of 1917 was $3,672,703. The dwindling production marks the gradual exhaustion of the phenomenally rich claims on the various creeks, but does not mean a corresponding decline in the mining industry as the amount of gravel handled has if anything increased in recent years. The decreased returns are due to the lower grade of the gravels mined. In the early days of the camp most of the work was done with pick and shovel. More economic methods, such as dredging and hydraulicing, are now being introduced.

Outside the Klondike district, some placer mining is being done on the upper waters of the Stewart, on the south branch of the Big Salmon and on the headwaters of the Alsek and White rivers. A certain proportion of the territory is still unprospected.

Ore Mining.— Ore mining follows placer mining in most mining camps, and such promises to be the case in the Yukon. Quartz veins carrying free gold have been found at several points in the Klondike district. An important copper belt occurs west of Whitehorse. Some development work has been done on a few of the claims and some rich ore, principally bornite, has been shipped to outside smelters. Native copper, sometimes in large masses, occurs loose in many of the creeks at the head of White River, but has not been traced to its source. Numerous discoveries of quartz veins carrying high grade silver minerals have recently been made in the vicinity of Windy Arm, Tagish Lake. Work is being actively prosecuted on some of these veins with very satisfactory results. Besides those mentioned, discoveries of ores of various kinds have been reported from nearly every section of the territory.

Coal Mining.— Seams of lignite coal of good quality occur at several points along the Yukon River, and a sufficient quantity is mined to supply the small local demand. Anthracite coal also occurs in the region southwest of Whitehorse but has not so far been worked.

Agriculture.— Experiments made during the past few years have shown that nearly all the common vegetables can be grown successfully in the Yukon valley, and there is every reason to believe that in the near future produce of this kind will be raised in sufficient quantity to supply the local market.

R. G. McCONNELL,
Geological Survey of Canada.

YUKON GOLD FIELDS. See ALASKA; CAPE NOME; KLONDIKE.

YULAN, a Chinese tree. See MAGNOLIA.

YULE, yool, SIR HENRY, British geographer and Orientalist: b. Inveresk, Midlothian, Scotland, 1 May 1820; d. London, 30 Dec. 1889. He was educated at Addiscombe and in 1840 was appointed to the Bengal Engineers, serving in both Sikh Wars. He retired from the army with rank of colonel in 1862 and in 1864 took up his residence at Palermo, Sicily, in order to continue and extend the researches which led to the publication of his great work, 'The Book of Ser Marco Polo, the Venetian' (1871–75), which gained him the founder's medal of the Royal Geological Society. In 1875 he returned to England, and from that year till 1889 was a member of the Indian Council. His other works include a treatise in 'Fortification,' which was used as a textbook; 'Narrative of a Mission to the Court of Ava in 1855' (1858); 'Cathay and the Way Thither' (1866); 'Notes on Hwen Thsang's Account of the Principalities of Tokharistan' (1872); 'Hobson-Jobson: a Glossary of Anglo-Indian Colloquial Words and Phrases, and of Kindred Terms, etc.' (1886), with A. C. Burnell; 'The Diary of William Hedges' (1887–89), edited for the Hakluyt Society, of which he was for many years president.

YULE, the old English name for Christmas, still used provincially and in poetry or poetic phrases. See CHRISTMAS, and consult Pringle, Mary P., 'Yule-Tide in Many Lands' (1916).

YULEE, David Levy, American politician: b. West Indies, 1811; d. New York, 10 Oct. 1886. In boyhood he came with his father, whose name was Levy, to Richmond, Va., where he was educated. Sent to Florida in 1824, he there studied law, became a planter, and being elected to Congress, served from 1841 to 1845, changing his name at this time from David Levy to David Yulee. He was United States senator from Florida 1845–51, taking a prominent part

in senatorial debates, and again 1855–61, when he resigned on account of the Civil War. He was then made a member of the Confederate Congress. After the war he became president of the Atlantic and Gulf Railroad, and was interested in the commercial development of Fernandina and Cedar Keys, Fla.

YUMA, yoo'ma, Ariz., city, county-seat of Yuma County, on the Colorado River, and on the Southern Pacific Railroad, 150 miles southwest of Phœnix. It is in a mining region in which there are considerable productive farm lands on which are raised grains and fruits. Its climate is remarkable for its dryness, its rainfall of 3.13 inches being the lowest recorded by the United States Weather Bureau Station. There are several churches, a high school, hospital and excellent county and Federal buildings and banking facilities. Pop. 2,914.

YUMAN STOCK, an important family or linguistic stock of North American Indians, the tribes composing it being scattered from the Colorado River region of Northern Arizona to the southern extremity of Lower California and even into the Mexican state of Sonora. The most important tribes of the stock are the Cochimi, Cocopa, Comeya, Cuchan, Diegueño, Havesupai, Maricopa, Mohave, Yavapai, Pericu, Seri, Tonto, Waikuru and Walapai. Of these, the Maricopa, or Coco-Maricopa, formerly inhabited the region around the confluence of the Gila and Colorado rivers. Their descendants and the Pimas, with whom they subsequently confederated, are now to be found in the Gila River Reservation to the number of about 400. They were an agricultural people and raised large crops by irrigation. Under missionary influence they have been civilized and are now noted for their industry, their efforts at self-improvement, and their manufactures of cotton cloth, baskets and pottery.

The Seri Indians (Opata, "Spry") speak a distinct language and live on Tiburn Island, in the Gulf of California, and the adjacent mainland of Sonora, Mexico. Their houses are flimsy bowers of cactus and shrubbery, sometimes rudely shingled with turtle shells and sponges. They make graceful balsas of canes lashed together for use in navigating the strait between their island and the mainland. They also manufacture a very light pottery and some basketry. The modern Seris are loosely organized into a number of maternal groups or clans in which polygamy prevails. They manifest implacable hatred toward aliens whether Caucasian or Indian and regard the shedding of alien blood as a great virtue. The population of the tribe was formerly several thousands but by constant warfare this number has been greatly reduced.

The name Tonto (Spanish, "foolish") has been inappropriately applied by the Spanish colonists of Arizona in the 19th century to a number of Indian tribes, namely: (1) To the Tulkepaia, a tribe of the Yuman stock settled in 1875 on San Carlos reservation Arizona. (2) To the Eoyotero Apaches, an Athapascan tribe. (3) To the Pinal Apaches of the same stock. (4) To a mixture of Yavakai (Yuman) men and Pinal women who have intermarried. The name has been especially applied to the last-mentioned body, who formerly occupied Tonto Basin and the Pinal Mountains of central Arizona, whence some 500 of them were removed to the Rio Verde reservation and later to the San Carlos reservation. They number about 700, and speak a mixed Yuman-Athapascan language.

The Mohave Indians reside in Arizona and California in the region of the Colorado River. There were in 1896 upward of 2,000 Mohaves remaining, 600 of whom live on the Colorado River Reservation in Arizona. They are an agricultural people, rank high physically and are expert makers of pottery and baskets. They practised tattooing and cremated their dead. The Yuma reside in the valley of the lower Colorado River in Arizona and California. Pop. about 655. The Cochimi were formerly the most populous of the tribes of Lower California but only a few are now extant. They live mainly about Loreto Mission. The Cocopa formerly occupied the valley of the Colorado River up to the Gila junction, but the remaining members now live mostly in Mexican territory. The Havesupai occupy the gorge of Cataract Creek, a branch of the Colorado River, in northwestern Arizona. The Mohave Yavapai left the main tribe in the Colorado valley and migrating to the Rio Santa Maria district, in 1873 were removed to the Camp Verde agency; but since 1875 they have been under the San Carlos agency. The Walapai originally occupied the territory above the Mohaves on the Colorado River. The total number, 20,000, who originally inhabited the United States, has been greatly depleted and at present there are not more than 6,000 living within the limits of the United States on reservations. But many members have become full-fledged citizens and no longer figure as wards of the United States. Of these no record is kept.

YUNG-LO, Chinese emperor, third of the Ming dynasty: b. 1360; d. 1424. He was the eldest son of Emperor Hung-wu, but was absent at the time of the emperor's death in 1398 and was superseded on the throne by a nephew, Kien-Wên. In 1403, however, Yung-lo reached Nanking with his forces, entered the city and assumed his place as emperor, compelling the flight of Kien-Wên. He conquered Cochin China and Tongking, and made successful war against Tartary. He was a famous patron of literature, particularly as sponsor of the 'Yung-lo Ta Tien'—'The Standard of Yung-lo,' a collection of all the literary work known to the Chinese down to that period. It was completed under the supervision of three scholars who were assisted by 2,166 literary workers, and when finished there were 22,877 books with a table of contents filling 60 books. The work was never printed, but three complete copies were made. Of these all have perished except about 11,000 books of one set.

YUNG WING, yoong'wing', Chinese diplomatist and scholar: b. Nan Ping, province of Kwang Tung, 17 Nov. 1828; d. 21 April 1912. After graduation from Yale in 1854, he was in the silk and tea trade until 1864, and then entered the governmental service of China. The China Steam Navigation Company was established on his initiative, as was also the Chinese Educational Mission, for the education of Chinese in America. Yung Wing was made chief commissioner of this enterprise, for which an appropriation of $1,500,000 was made by the

Chinese government. He was granted the rank of mandarin of the second grade, and appointed intendant of Kiang-Su province; and was for four years associate resident minister to the United States, where he took up his residence in 1902. Author of 'My Life in China and America' (1909).

YUNNAN, yŭn-năn', China, the most southwesterly and second largest province of the empire, bordering on Tonkin and Burma; area, about 146,680 square miles. It is very mountainous in the north and west, and has a general slope toward the southeast. The central part is a plateau about 6,500 feet above sea-level, dotted with lakes and diversified by hills of red sandstone; but in the south the elevation of the land is much less. The province is traversed by several large rivers, principally the upper courses of the Yangtse-kiang (called Kin-cha-kiang), the Si-kiang, the Song-ka or Red River, the Mekong and the Salwin, but only the Song-ka can be regarded as of use for navigation within the province. The principal crops are rice, maize and wheat, but tea, indigo, sugar-cane, cotton, earth-nuts, and many vegetables also are cultivated. Opium was an important crop until 1907, when its cultivation was forbidden. Cattle, sheep, hogs and other animals are reared in considerable numbers, and silkworm-rearing is also extensively carried on. The chief wealth of the province, however, lies in its immense mineral resources, which include iron, coal, copper, gold, silver, lead, tin, zinc, cinnabar and precious stones. The manufacturing industries include the making of silk goods and other textiles, leather goods, etc. The climate varies from the rigor of the northern districts, where the mountains are snow-capped for the greater part of the year, to the comparatively tropical condition of the southeast. A large part of the population consists of Miao-tse and other non-Chinese elements, and Mohammedanism has many adherents. Yunnan, the capital, in the southeast, is a busy and prosperous town, with large copper factories, and manufactures of silks and carpets. (Pop. 150,000). Other towns are Chaotung, Tali-fu, Momein, Linganfu, Puerh, Tung-chwan, Mengtse and Ssumao, the last two being open to foreign trade since 1889 and 1897 respectively. The British have endeavored to establish a direct trade route between Yunnan and Burma, but from the physical features of the region this is not easy. The history of Yunnan can be traced back to the 3d century B.C. Owing to its distance from the seat of the central authority and its mountainous character this province long remained practically independent. It was conquered by Kublai Khan but was not incorporated in the empire until the 17th century. The most noteworthy event of its recent history is the great Panthay revolt of 1855, which was not suppressed by the Chinese authorities till 1873; and from the effects of which, owing to the merciless measures taken, the province has not yet wholly recovered. The first Protestant Christian mission work was begun in 1877. Pop. (estimated) 12,324,574.

YUPANQUI PACHACUTI, yoo-păn'kē pă-chă-koo'tē, or **PACHECUTEC YUPANQUI**, Peruvian inca: b. about 1380; d. about 1440. He was the ninth ruler of the Inca line of sovereigns, and one of the greatest. He was the second son of the Inca Viracocha and after deposing or superseding his imbecile elder brother, Urco, he defeated the Chancas in a great battle, annexed their territory to his own and continued his successful career till the Inca kingdom included nearly all of what is now the republic of Peru. In order to relieve the congested condition of Peru he developed a system of colonies called mitimaes. Yupanqui figures largely in Quechuca tradition and various national institutions have been traced to him. He was grandfather to Stahualpa, ruler of Peru at the time of its conquest by Pizarro.

YUROK. See WEITSPEKAN INDIANS.

YURUARY, yoo-roo-ā'rē, a river of Venezuela, rising to the east of the Caroni and flowing eastward to join the Cuyuni in about long. 61½° W., near the frontier of British Guiana. It gives its name to the Yuruary territory claimed by both Venezuela and Great Britain until 1899, when the award of an arbitration court gave most of it to Venezuela. There are several gold-fields here, including El Callao, etc.

YURUCARES, yoo-roo-kā-rās', or **YURUCARE**, Indians of Bolivia occupying the forest plains on the eastern slope of the Andes between the rivers Mamore and Beni. They include several tribes, are tall and shapely, and are almost white. They plant maize and manioc but are hunters and warriors for the most part. They are said to give complete liberty to their children, never punishing them but sometimes killing them in order to be rid of them. They dress in a bark cloth which they print with figures by means of engraved blocks; engage in duelling with bows and arrows; and make an intoxicating liquor from maize which is imbibed freely in their festivities. Their mythology is intricate and confused. Prior to the expulsion of the Jesuits, in 1767, numbers of them were attached to the Chiquito missions. They number about 2,000.

YUSUF, yoos'ŭf, or **YUSSUF, Abu Amru**, Arabic historian: b. Cordova, about 976; d. Xativa, 1070. He was profoundly versed in the traditions of the Oriental Mussulman countries and wrote 'Behedjet-Almodjalisyn,' a collection of tales relating to Mohammed, etc.; 'Tamhyd,' a commentary on one of the chief Mussulman works of religious and civil law; 'History of the Opinions and Doctrines of the Principal Mussulman Sects'; 'History of the Wars Against the Christians,' etc.

YUSUF, or YUSSUF-BEN-TAXFYN, Moorish prince: b. Velad, Sahara; d. 1106. He was the second prince of the Almoravide line and in 1086 aided the Emir of Seville, Al-Mo'tamid, to gain the victory over Alfonso VI at Zalaca near Badajoz. In 1090 he again invaded Spain, at the call of the emir of Seville, and taking advantage of Mohammedan dissensions, gradually acquired the sovereignty of the kingdoms of Malaga, Grenada, Murcia, Cordova, Seville, Almeria, Badajoz and Valencia, which he united to the kingdom of Morocco. Notwithstanding his power, Yusuf never assumed a higher title than that of emir, and in 1103 his son Ali was acknowledged heir of both

Z

Z the twenty-sixth of the letters of the English alphabet, is a vocal or sonant consonant, as distinguished from *s*, which is the corresponding fricative sibilant. It was adopted into the Latin from the Greek alphabet in the time of Cicero: in the Latin alphabet, as in our own, it holds the last place; but in the Greek its place is sixth, and in the Phœnician, Hebrew and other Semitic alphabets seventh. Its earliest Phœnician and Greek form was I. The name of the Greek letter is Zeta, that of the Phœnician Zayin. The Greek name is either derived from that of the Phœnician letter Zade, or has been assimilated to Eta and Theta. In German and Italian it represents the sound of *ts;* in our language and in French it represents one simple sound. In Latin it was used only in words derived from the Greek. The exact value of zeta in Greek is not known with certainty; but beyond any question it stood for a double sound, not a simple sound like our *z;* this is conclusively inferred from Aristotle's remark that *xi* (ξ), *psi* (ψ), and *zeta* (ζ) are like in sound; and the inference is strengthened by the fact that in Greek prosody a vowel short by nature is made long by position when it occurs next before the zeta. The sound of the zeta, however, is in doubt — whether it was *dz* or *zd* or both. The name of Z in Great Britain is *zed*, in the United States *zee*. *Z* is often related to palatal sounds as *zealous, jealous*, etc. Though *z* is the alphabetic representative of the sonant sibilant, the special *z*-sound is in English and many other languages oftener represented by *s* than by *z*. In *azure* and some other words *z* is the sonant corresponding to *sh*. See ALPHABET.

Z-BARS. See RAILS AND STRUCTURAL SHAPES.

ZABERN, or SAVERNE (anc. *Tres Tabernæ*), Alsace, a town in lower Alsace, on the Rhine-Marne Canal, at the foot of a pass over the Vosges Mountains, 24 miles northwest of Strassburg, and on the railway to Avricourt. There is an episcopal palace, rebuilt in 1779, and under German rule used as a barracks; a church dating from the 15th century, and many ruined castles. The town was of importance in the time of the Romans, was destroyed by the Alemanni in 357, and was rebuilt by the Emperor Julian. It suffered greatly in the Thirty Years' War. It came prominently into public notice in 1913 through the "Zabern Incident." The 99th Infantry was garrisoned there and it was said that the soldiers were encouraged by their officers in maltreating the Alsatians. Affairs came to a climax when a young nobleman of the German army, Lieutenant von Forstner, offered 10 marks to any soldier who would bayonet an Alsatian, then further compromised himself by striking with his sword a lame shoemaker. The incident aroused a furore of indignation, not only in the French press, but in Germany. In the Reichstag it reached such importance that a vote of no confidence was passed against the government, 293 to 54. This, however, had no result except as an expression of disapproval, the chancellor announcing that he held his office through imperial appointment and subject to no other control. von Forstner was upheld by his superior officers, and although subjected to the form of a court-martial was acquitted. The emperor's decision regarding the matter was that the honor of the army must be upheld with neither compromise nor apology. Pop. 8,643.

ZABIANS, a term not identical with Sabæans, but properly meaning certain non-Christian Gnostics, predecessors of the peculiar sect called Mandæans, still surviving in South Babylonia. The Cyrian Zabians were the survivors of the ancient Syrian heathen who, being under Mohammedan rule, took the name of Zabians in order to share the toleration which the followers of Mohammed extended to the real Zabians. This sect became extinct about the 12th century. See MANDÆANS.

ZACATECAS, tzä-kä-tä'käs, a Mexican city and a state of the same name bounded by Coahuila, San Luis Potosi, Aguascalientes and Durango. The city of Zacatecas is 439 miles from Mexico City and 785 miles from El Paso, Tex., and is situated at an elevation of 8,044 feet above sea-level. It lies in a narrow and deep ravine, and is surrounded and closely abutted on three sides by mountains or high hills. It possesses a chain of mines many of which are among the oldest in the Republic and have produced enormous quantities of precious metals. Not all these are now worked, a number having seemingly become exhausted in so far as satisfactory returns are concerned. A public library containing some 20,000 volumes is maintained by the local government. The most notable buildings are the historic old Cathedral, with its front wall a mass of artistic carving, and the Theatre, a very imposing structure of modern design. In the heart of the city is the Market House, an iron building admirably adapted to its uses and of pleasing appearance. A few minutes' ride southward toward a broad valley is the little village of Guadalupe, where there was a Chapel of Gold, built by a devout woman and ornamented throughout in solid gold gilt at great cost, estimated at not less than $1,000,000. Here, also, is located the State Industrial School for poor boys, in which shoe-making, tailoring, cabinet-making, and other trades are taught, together with the rudiments of a common school

education. There are The School of Arts, the Benito Juarez School and several other educational institutions of merit; the Civil Hospital and two theatres,— the González and the Calderón. Pop. about 60,000.

ZACCHAEUS, a New Testament character. He was a tax collector living near Jericho. Only one detail of his life is given,— he was short of stature. Jesus was accompanied by a crowd and in order to see the famous Rabbi, Zacchaeus climbed a tree. He was a Jew, but ostracised as an alien and outcast because of his business, so that Jesus by taking up his abode with him gave a blow at Jewish caste and at the same time laid himself liable to the criticism that arose, because he had accepted the hospitality of "a man that was a sinner." According to tradition Zacchaeus became the companion of Peter and finally Bishop of Caesarea in Palestine.

ZACHARIA, tsä-ha-rē'ä, **Heinrich Albert,** German publicist: b. Herbsleben, Saxe-Gotha, 20 Nov. 1806; d. Kannstadt, 29 April 1875. He was graduated from the University of Göttingen in 1829, was lecturer there in 1835–42, and in 1842 became professor of law. He took active part in the political movement of 1848 as a member of the National Parliament; in 1866 he opposed annexation to Prussia; and in 1867 took a leading part in the convention which framed the constitution of the North German Confederacy. He wrote 'German States' Rights and Federal Rights' (1841); 'Manual of German Criminal Procedure' (1860); 'German Constitutional Laws of the Present Time' (1855); 'The Question of the Competence of the Empire in View of the Dogma of Infallibility' (1871).

ZACHARIA, Just Friedrich Wilhelm, German poet: b. Frankenhausen, 1 May 1726; d. Brunswick, 30 Jan. 1777. After studying at Leipzig and Göttingen he became professor of belles-lettres in the Carolinum, Brunswick. He wrote: 'Der Rennomist' (The Brawler) (1744), the first burlesque heroic poem that had appeared in German; 'Fables and Tales' (1771), etc.; and translated into German hexameters Milton's 'Paradise Lost' (1760).

ZACHARIÄ VON LINGENTHAL, ling'-ĕn-täl, **Karl Eduard,** German writer on Jurisprudence, son of Karl Salomo Zacharia von Lingenthal (q.v.): b. Heidelberg, 21 Dec. 1812; d. Grosskmehlen, near Merseburg, 3 June 1894. He was educated at Leipzig, Berlin and Heidelberg, and traveled widely in Europe and in the East, making exhaustive researches in Roman and Byzantine law. He is regarded as the founder of the science of Græco-Roman jurisprudence. His works include 'Outline of a History of Græco-Roman Jurisprudence' (1839); 'History of Græco-Roman Private Right' (1864); 'Græco-Roman Laws' (1856–84); 'Paralipomena ad Basilica' (1893); and an edition of Justinian's 'Novellæ' (1881–91).

ZACHARIÄ VON LINGENTHAL, Karl Salomo, German jurist: b. Meissen, Saxony, 14 Sept. 1769; d. Heidelberg, 27 March 1843. He studied at Leipzig and Wittenberg, was professor of law at the latter university, 1797–1807, and filled the same position at Heidelberg, 1807–43. He was active politically in 1820–29. His writings covered practically every branch of jurisprudence, dealing with Roman, Canon, German, English and French law, and paved the way for modern writing of the sort. He wrote 'The Unity of State and Church' (1797); 'Forty Books on the State' (2d ed. 7 vols., 1839–43); 'Hand-Book of French Civil Law' (8th ed. 1894–95), etc.

ZACHARIAS, zăk-a-rī'as, father of Saint John the Baptist and husband of Saint Elizabeth. He was a priest of the temple of Jerusalem, and was stricken dumb on refusing to believe the announcement, made by the angel Gabriel, that a son should be born unto him; but recovered his speech at the birth of Saint John the Baptist. He is supposed to have been put to death by Herod (Luke i, 5–79).

ZACHARIAS, or **ZACHARY, Saint, Pope:** of Greek birth; d. Rome, 14 March 752. He succeeded Saint Gregory III in the papal chair in 741 and at his death was followed by Stephen II. He exercised a powerful influence over several of the Lombard kings, obtaining the restoration of various cities and territories which had formerly been subject to the papacy, and gave his consent to the setting aside of the Merovingian Childeric III and the elevation of Pepin the Short to the French throne (1752). His day is commemorated 15 March.

ZACHARIAS. See ZECHARIAH.

ZACHER, tsäh'ĕr, **Ernst Julius August,** German philologist: b. Obernigk, Silesia, 15 Feb. 1816; d. Halle, 23 March 1887. He was educated at Berlin and Breslau and was professor of German philology in Halle 1856–59, and 1863–87. His works, which are greatly prized by students, include 'German Proverbs' (1852); 'Ulfilas' Gothic Alphabet and the Runic Alphabet' (1855); 'History of the Palgravine Genoveva' (1860); 'Pseudo-Callisthenes' (1867), dealing with the Alexander myth, etc.

ZACK. See KEATS, GWENDOLINE.

ZACYNTHUS zä-kin'thŭs. See ZANTE.

ZADKIEL, zăd'kĭ-ĕl, (1) According to Jewish legend the angel of the planet Jupiter. (2) A pseudonym adopted by William Lilly (b. 1602; d. 1681), the astrologer. (3) The name assumed by Richard James Morrison (b. 1794; d. 5 Feb. 1874), compiler of an astrological almanac, begun by him in 1830, and which reached an annual sale of from 100,000 to 200,000 copies.

ZADOK, zā'dŏk, (1) A high priest of Israel, contemporary with David. (See SADDUCEES). (2) A personage in Dryden's 'Absalom and Achitophel,' intended as a portrayal of Archbishop Sancroft.

ZADOKITE FRAGMENTS. The Zadokites are mentioned in the book of Ezekiel as the true upholders of the worship of Jehovah when Israel as a nation had deserted it. By some it is thought that their descendants settled in Damascus some time in the 1st century A.D. Some fragments discovered in the Cairo Genizah or Jewish Congregation, now in possession of Cambridge University Library, have been attributed to them with a date between 70 and 80 A.D. Considerable controversy arose concerning them among scholars in regard to their interpretation and implication. Rabbi Solomon Schechter published them under the Title 'Documents of Jewish Sectaries' (2 vols., Cambridge 1910). The best account of the history of the

manuscripts and sect is in an article in *The Biblical World*, Dec. 1911, by James A. Montgomery entitled 'A Lost Jewish Sect.'

ZAFFARIN ISLANDS, a group of three islands lying off the coast of Morocco, near the Algerian frontier. They are at the mouth of the Muluya River and shelter its harbor. They have belonged to Spain since 1848. The central island is fortified.

ZAFFRE, or **ZAFFER**, *in chemistry*, an impure oxide of cobalt containing some arsenic and made by roasting speiss cobalt. The residuum consists of a grayish oxide of cobalt, usually mingled with sand and other impurities. It is used in the manufacture of smalt and in other ways, but its importance in furnishing "cobalt blue" has been lessened by the discovery of methods of making artificial blue.

ZAGAZIG, zä-gä-zēg', or **ZAKAZIK**, Egypt, the chief town of the province of Sharkieh, in the delta of the Nile, on the Muizz and Ismailia or Freshwater canals, connected by rail with Cairo, Alexandria, and Suez, 40 miles north-northwest of Cairo. The great number of factories, with their tall chimneys, and the structure of the houses, give the place a European appearance, and testify to the industrial activity which prevails. Nearly all of the cotton grown in the eastern Delta is sent here to be cleaned, sorted and partly spun before being put on the market. The town is also a centre of the grain trade, and has rapidly increased in prosperity and population since its connection with Suez by the Fresh-water Canal. Many European merchants maintain offices here. The excavated ruins of the ancient Bubastis are in the vicinity. Pop. about 34,900.

ZAGOSKIN, zä-gŏs'kin, **Mikhail Nikolaievitch**, Russian author: b. government of Penza, 1789; d. Moscow, 5 July 1852. For some time he held a post in the department of mines at Saint Petersburg. His comedy, 'The Scapegrace,' was praised by Prince Tschaikovski, a dramatist of influence, and he wrote a number of others which had some success but were deficient in originality, although they gained for him the appointment as director of the Court Theatre as Moscow. His efforts in the domain of historical fiction, with Scott as a guide, were more worthy, the chief being 'Yuri Miloslavski' (1829) and he has been called the "Russian Walter Scott." There were half a score of others, their subjects derived from Russian history or legend. Their patriotic quality assured them an audience on their first appearance, and that they do not yet lack for readers is shown by the beginning of a complete edition of his works in 1898. There is a Russian biography by Aksakov in an edition of selected works published in 1858.

ZAHM, tsām, **John Augustine**, American author: b. New Lexington, Perry County, Ohio, 14 June 1851. He received his education at Notre Dame University, where he was graduated in 1871. He at once entered the order of the Holy Cross; and occupied the chair of physics at Notre Dame for 25 years, for the greater part of which time he was also head of the scientific department there. He was for many years president of the board of trustees of the university, provincial of his order in the United States and procurator-general of his community in Rome, where he enjoyed the special favor of Leo XIII, who conferred on him the degree of Ph.D. in 1895. Dr. Zahm has lectured at the summer schools at Plattsburg, N. Y., and at Madison, Wis.; also at the New Orleans winter school and the Catholic University of America. In scientific circles, his position as an advanced evolutionist has brought him into prominence. He is a member of the Société Française de Physique; the Société Scientifique of Brussels; the Arcadia, Rome; and the Dante Society of Florence. His published works include 'Evolution and Dogma'; 'Bible Science and Faith'; 'Sound and Music'; 'Catholic Science and Catholic Scientists'; 'Scientific Theory and Catholic Doctrine'; 'Science and the Church'; 'Evolution and Teleology'; 'Souvenirs of Travel'; 'Alaska: The Country and the People'; 'Hawaii and the Hawaiians.' Dr. Zahm has devoted many years to the study of South America and on this subject has written, under the pseudonyms of H. J. Mozans and J. A. Manzo 'Following the Conquistadores by the Orinoco and Down the Magdalene'; 'Following the Conquistadores Along the Andes and Down the Amazon'; 'The Quest of El Dorado'; 'Woman in Science'; 'Following the Conquistadores Through South America's Southland, with an Account of the Roosevelt Expedition to South America.'

ZAHN, tsān, **Ernst**, Swiss novelist and writer of short stories: b. Zurich, 24 Jan. 1867. In 1873 his father, an innkeeper, bought a hotel at Siders in the canton of Wallis and here Ernst obtained his first instruction in the Protestant Elementary School. In 1875 he went to Zurich, where his grandparents took charge of him and sent him to the public schools, later (for three years) to the gymnasium. His father leased, in 1880, the restaurant in the railroad station at Goschenen, at the entrance to the Saint Gotthard Tunnel, and here Zahn worked as a waiter in 1883. For a year and a half he also attended the Breidenstein International Boys' School at Grenchen, canton of Solothurn. In all these various capacities, and in spite of a much interrupted education, he was energetically pursuing every opportunity that presented itself to him for increasing his knowledge. In the winter of 1885 he again worked as a waiter at Hotel Beaurivage, Geneva; in the winter of 1886 he was at Hastings, England, learning the language; in 1887 he was hotel clerk at the Hotel de la Ville, Genoa. He returned to his father's restaurant in 1888, becoming a partner in 1894 and taking sole charge in 1897. The town of Goschenen made him a town councillor, and one of his first acts in office was to cause the erection of a monument for the constructor of the Mount Saint Gotthard Tunnel and for the many laborers who met their death during its construction. In 1902 he became judge of the Uri Criminal Court, in 1904 a member of the Cantonal Council of Uri, in 1908 its president. He received the honorary degree of Ph.D. fro mthe University of Geneva in 1909. He has written an unusual quantity of stories of Swiss local life, which are very attractive in form and correct in technique. Some of his short stories seem like faultless works of art, especially 'Stephan der Schmied' and 'Verena Stadler.' In his larger works, however, he has not devoted his atten-

tion chiefly to the difficult task of analyzing serious conflicts of character, but rather to more or less superficial problems, with the result that he is drifting more and more into the position of a writer interested only in success, which will therefore perhaps not be of very durable character. Consult 'Gesammelte Werke' (10 vols., Stuttgart 1910); 'Herzenskämpfe' (1893); 'Die Clari-Marie' (1904); 'Die Helden des Alltags' (1905; 20th ed., 1912), 'Firnwind' (1906); 'Der Apotheker von Klein Wehwil' (Stuttgart 1913). A translation of 'Stephan der Schmied' is given in 'German Classics' (Vol. XIX, New York 1914).

JACOB WITTMER HARTMANN.

ZAHN, Johann Karl Wilhelm, German architect, painter and art critic: b. Rodenberg, Schaumburg, 21 Aug. 1800; d. Berlin, 22 Aug. 1871. He became professor in the Academy of Arts, Berlin, 1829. He superintended excavations at Herculaneum and Pompeii; cast the finest bronzes and silver vases for the Museum Borbonico; and was architect of many fine houses and villas in Pompeiian style in England and America. Author of 'The Most Beautiful Ornaments and the Most Notable Pictures from Pompeii, Herculaneum and Stabiæ' (1828-30); 'Ornaments of All Classical Periods of Art' (1832-39).

ZAHN, Theodor, German theologian: b. Mörs, Prussia, 10 Oct. 1838. After studying at Basel, Erlangen and Berlin he became professor of theology in the University of Göttingen in 1871. He filled a similar chair at Kiel in 1877, at Erlangen in 1878, at Leipzig in 1888 and in 1892 returned to Erlangen. He became a foremost authority on the New Testament. Among his works may be named 'Marcellus of Ancyra' (1867); 'The Shepherd of Hermas' (1868); 'Ignatius of Antioch' (1873); 'The Acts of Saint John' (1880); 'Cyprian of Antioch and the German Story of Faust' (1882); 'Researches Into the History of the New Testament Canon' (1881-93); 'The Gospel of Peter' (1893); 'Introduction to the New Testament' (1897); 'Das Evangelium des Lucas' (1913), etc.

ZÄHRINGEN, tsā'rĭng-ĕn, the house from which the former grand-ducal family of Baden (q.v.), Germany, took its origin. The name is derived from the castle of Zähringen, now in ruins, in the village of that name, about two miles north of Freiburg in Baden. The founders of the family were from the 8th to the 10th century Counts of Breisgau, but the history of the house really began with Duke Bertold I, "the Bearded," d. 1078, who began to rule in the first third of the 11th century. Bertold II took the title of Duke of Zähringen in 1090. The main line of the family became extinct in 1218 and their territories, which included lands in Burgundy and Switzerland as well as Baden, were divided. A portion passed through a younger branch of the house to the Counts of Kyburg and thence to the Hapsburgs, to whom they are related. The remaining lands descended to the former reigning family of Baden.

ZAIMIS, Alexander, Greek statesman: b. Athens, 1855. He was educated at the universities of Athens, Leipzig, Berlin, Heidelberg and Paris. He was elected to the Chamber of Deputies in 1885; served as Minister of Justice in 1890-92, and was president of the Chamber of Deputies in 1895-97. He was Premier in 1897-99, under King George, and again in 1901-02. He was High Commissioner of the Powers in Crete in 1906-11 and was successful in securing the annexation of that island to Greece. He was appointed Premier to succeed Venizelos in October 1915, but resigned a month later when his government failed to receive a vote of confidence. He was again appointed Premier in June 1916, but was succeeded by Lambros before the end of the year, only to succeed Lambros in May 1917. Upon the abdication of King Constantine, however, he was asked to resign, and was succeeded by Venizelos 25 June 1917. He was generally supposed to favor neutrality for Greece in the European War, but to be personally in favor of the Allies.

ZAIRE, zā-ē'rā, Africa (a Portuguese variant of the Bantu word, *nzari*), the name by which the Kongo River was known before the possession of the banks of its lower course by the Kongo tribe, and still much used until the last quarter of the 19th century.

ZAKAZIK, zā-kā-zēk', Egypt. See ZAGAZIG.

ZALESKI, zā-lĕs'kĭ, **Bohdan,** Polish poet: b. Bohaterka, in the Ukraine, 14 Feb. 1802; d. Villepreux, near Paris, 31 March 1886. He studied at Warsaw and being obliged to leave his country after the revolution of 1830, he went to France. Many of his poems depict in the most vivid manner the scenery of Poland, as well as its history and legends, in which he was well-versed. His chief works are 'The Spirit of the Steppes' (1842); 'The Most Holy Family' (1851), and collections of shorter poems.

ZALEUCUS, zā-lū'kŭs, the legendary lawgiver to the Epizephyrian Locrians, the Greeks who colonized Magna Græcia, the southwest extremity of Italy. He is supposed to have flourished in the middle of the 7th century B.C. and his code is said to have comprised the first written laws of the Greeks. According to tradition his laws were exceedingly severe.

ZALINSKI, Edmund, American soldier and inventor: b. Kurnich, Prussian Poland, 13 Dec. 1849; d. 10 March 1909. Coming to the United States in 1853 with his parents, who settled at Seneca Falls, N. Y., he was educated at the Syracuse High School, and entered the army in 1864 as volunteer aid on the staff of Gen. N. A. Miles. He was appointed second lieutenant Fifth United States Artillery in 1866, and captain in 1887. He was professor of military science at the Massachusetts Institute of Technology 1872-76, and was appointed second lieutenant Fifth United States Artillery School at Fort Monroe and the School of Submarine Mining at Willett's Point, N. Y. From 1883 to 1889 he devoted himself to the development and perfecting of a pneumatic dynamite topedo gun. Among his inventions are an intrenching tool, a ramrod bayonet, a telescopic sight for artillery and a system of range and position finding for sea-coast and artillery firing. He retired from active service in 1894 and was promoted major in 1904. See ORDNANCE.

ZALINSKI GUN. See ORDNANCE.

ZALOKOSTAS, Georgios, Greek poet: b. Syrrhako, Epirus, 17 April 1805; d. Athens, 3 Sept. 1858. An ardent patriot, at 16 he fought in the insurrection at Missolonghi. Greek children are taught his songs, and among his best-known poems are 'Missolonghi'; 'Armatoles and Klepts'; 'The Entrance of Prevesa'; 'Hours of Leisure'; 'Marco Bozzaris,' etc. Several of his verses have been translated into Italian, Spanish, English, German, French and Russian. His 'Poetical Works' were published at Athens in 1860.

ZALUSKI, zä-loos'kē, **Josef Andrezei,** Polish prelate and scholar: b. Poland, 1702; d. 9 Jan. 1774. After serving for three years at Rome as ambassador to Pope Clement XII he was made bishop of Kiev, but was banished to Kaluga and imprisoned there in 1766-73 for his opposition to the Dissidents. He is chiefly remembered for the service he did in awakening Polish literature. He spent his fortune in collecting a great library, which he bequeathed to Poland, but which was taken by Russia after the partition, and formed the nucleus of the Imperial Public Library. He was a great scholar and while in prison wrote from memory a versified account of the Polish histories in his collection. He was not a great writer but his works have a high historical and bibliographical value. Author of 'Biblioteka historyków' (1832); 'Specimen historiæ Poloniæ criticæ (1733).

ZAMA, zā'mą, North Africa, the name of two ancient cities about 30 miles apart, 100 miles southwest of Carthage, now represented by Djiama and Sidi Amor-Djedidi. Both claim to be the scene of the victory of Scipio Africanus over Hannibal, which decided the fate of Carthage 202 B.C. It led to an ignominious peace which closed the Second Punic War 201 B.C. The Romans lost about 2,000 killed and wounded, while the Carthaginians lost in killed and prisoners over 40,000.

ZAMACOIS, thä-mä-kō'ēs, **Eduardo,** Spanish artist: b. Bilbao, Vizcaya, 1842; d. Madrid, 14 Jan. 1871. He was a pupil in Madrid of Balaca, Federico de Madrazo, and the Academy; in Paris, of Meissonier and the Beaux-Arts; and has been ranked as second to only Fortuny among Spanish genre-painters of the 19th century. His subjects were drawn largely from the 16th and 17th centuries, and were frequently treated in a satirical vein. His technical finish has been described as "almost as perfect as Meissonier's." Among his paintings are 'The Hunchback'; 'Spanish Recruits'; 'The Bull Fighters'; 'Indirect Taxes'; 'A Court Jester of the 16th Century'; 'The King's Favorite' (1867); 'Cervantes as a Recruit'; 'The Rival Confessors' (1868); 'Return to the Convent' (1869); 'The Education of a Prince' (1870); 'The Puzzled Musician.' Many of his works are in private collections in the United States.

ZAMBALES, thäm-bä'läs, Philippines, a province of Luzon, in the southwestern part of northern Luzon; bounded on the west by the China Sea; on the north by the province of Pangasinán: on the east by the provinces of Pangasinán, Tárlac, and Pampanga; and on the south by Bataan and Subig Bay; length, 80 miles; width, 28 miles in the southern part, 25 miles in the nortern part, and 12 miles in the central part; area, about 1,650 square miles. The Zambales Mountain range near the eastern boundary parallels the coast, and has several points of high elevation, High Peak being 6,683 feet in height, Mount Pinalobo, 5,524 feet and Mount Guadradro 5,443 feet; there are also two groups of peaks but a few miles inland from the coast. There are numerous short rivers, and several thermal springs in the province. The chief industry of the province is agriculture; rice and wheat of superior quality are the special products; sugar, cotton, tobacco and coffee are also extensively cultivated. Next to agriculture in importance is the raising of cattle, horses, carabaos and hogs. The mechanical industries are very limited and primitive; copper and coal are mined; and there are indications of iron. The forest products are valuable, and amber is collected in considerable quantities on the coast. There are but few roads, and these are mostly impassable in the rainy season; a road and telegraph line parallel the coast for the greater part of the distance. Civil government was established in August 1901, and the provincial governor reported the province in a peaceful and prosperous condition in January 1902. The chief town and capital is Iba, a seaport (Pop. 4,482). Until 1904 the province extended north to Lingayen Gulf, but a re-division of territory then gave the territory north from Dasol Bay to the province of Pangasinán. Pop. 101,381.

ZAMBESI, zäm-bē'zē, or **ZAMBEZI,** South Africa, a river rising in Portuguese West Africa, in lat. 11° 21' 3" S., and long. 24° 22' E., and reaching the Indian Ocean at Chinde and Conceifao in Portuguese East Africa, opposite Madagascar, after a total course of 2,200 miles, of which the middle part belongs wholly to Rhodesia. The Victoria Falls and the Kebrabasa Rapids, the former in the west of Rhodesia and the latter in Portuguese East Africa, above Tete, are regarded as dividing the river into three sections, the Upper, Middle and Lower Zambesi. The neighborhood of the source has an altitude of about 5,000 feet, and the river has its origin in a deep depression at the base of steep undulations, where the water oozes from a black marshy bog and quickly collects into a well-defined stream. Another head-stream of the Zambesi is the Kabompo, which rises in the northwest of Rhodesia, about lat. 11° 34' S., and long. 25° 17' E., also at an altitude of 5,000 feet, and in a region of open grassy downs. The former stream, at first known as Yambeshe and then as Liambai (Liambeshe), flows at first west with a southward trend, and then turns south-southeast. Ten miles of rapids precede the Sapuma cataracts (13° 7' S.), where the river flows "through a narrow rocky fissure into a pool of considerable extent." At about 14° S. it is joined by the Kabompo from the northeast, and the remaining course of the Upper Zambesi has a south and southeasterly direction through the low-lying, grassy Marotse country, and is marked by various cataracts and rapids. Sesheki is a place of some importance on the left bank, near where the river begins to be wholly in British territory; and a short distance farther down, opposite Kazungula, it receives

from the west the waters of the large tributary Kuanda. In about 18° S. there are the celebrated Victoria Falls (q.v.), discovered by Livingstone in 1855. Here the broad river suddenly plunges into a transverse chasm 400 feet deep amidst a scene of tremendous grandeur. The gorge just below (eight miles long) and in full view of the falls is spanned since 1904 by a lofty bridge on the Cape to Cairo Railway. The Middle Zambesi, whose direction is east, northeast and again east, receives the Guay-Shangani and Sanyati from the south; the Kafukwe and Loangwa from the north, the latter at Zumbo, where the river leaves British territory; and is interrupted by various rapids and rocks, especially at low water, the Kebrabasa Rapids being the first impassable obstacle to navigation from the mouth. The remaining course of the river (Lower Zambesi) has been described as, except for the Lupata Gorge, "merely a broad expanse of sand, three to five miles wide, with low, reed-fringed banks, and intersected by numerous shallow streams." It passes the town of Tete, below which it is joined on the right by the Mazoe, and after passing Sena it receives from the left the Shiré from Lake Nyassa, the waterway to British Central Africa. It enters the Indian Ocean by several mouths, of which the Chinde one is the most practicable. The delta covers an area of about 25,000 square miles, and begins about 90 miles from the coast, a little below the confluence of the main stream with the Shiré. The river drains an area estimated at 600,000 square miles. Its basin is separated from that of the Orange River on the southwest by a slight watershed, and from that of the Limpopo on the south by a mountain range. The valley of the Zambesi is capable of immense development in the way of trade. The Portuguese government has long exercised sway for 300 miles from the mouths of the river, and by the international arrangement of June 1891 the river from the coast to the confluence of the Loangwa is recognized as being in Portuguese territory. The Zambesi and its affluents are now free to the flags of all nations. The Upper Zambesi was first explored by Livingstone, who reached the Liambai in 1851. Consult Coillard, 'On the Threshold of Central Africa' (1897); Gibbons, 'Africa from South to North' (1904); Livingstone, 'Narrative of an Expedition to the Zambezi and its Tributaries' (1865).

ZAMBESIA, zăm-bē'zhĭ-ą, one of the three districts of Portuguese East Africa, divided into the sub-districts Quilimane and Tete; also a name popularly applied to the regions in Rhodesia divided by the Zambesi, known respectively as North and South Zambesia, and sometimes called British Zambesia. See EAST AFRICA, PORTUGUESE; RHODESIA.

ZAMBOANGA, thăm-bō-ăn'gā, Philippines, (1) town, capital of the District of Zamboanga; on the southern coast, 17 miles across the strait from Isabela. It was founded in 1635 as a base of operations against Moro pirates; shortly before the American occupancy of the islands it was almost entirely destroyed by fire, partly by the Spaniards and partly by the Filipinos; since then it has been rebuilt. Many of the houses are of stone, and the town contains a fort, the Castle of San Felipe, a cathedral, a public hospital, the provincial capitol, completed in 1908, and a customs house. Since the American occupation the streets have been improved, public parks established and docking facilities have been extended. It is connected with Manila by steamer, and is the chief market in the southern part of the archipelago for hemp, copra and gutta percha. Pop. 30,000. (2) A District of Moro province, forming the western peninsula of the island of Mindanao, bounded on the north by Dapitan and Misamis, on the south by the Celebes Sea and Basilan Strait, on the east by Lanao and on the west by the Sulu Sea; area, with dependent islands, 6,085 square miles. The district was increased in size by the act of the Philippine Commission 1 June 1903. The main mountain range extends west and then southwest from the northeastern boundary; another range traverses the Bañganinan or Flecha peninsula. The climate is the best in the Philippines, the temperature varying but a few degrees. Agriculture and stock raising are the more important industries; rice, hemp, cotton, coffee, sugar, cocoanuts are cultivated; and cloves and nutmegs and vegetables are also among the valuable products of this province. Cattle, horses and hogs are raised. There is an abundance of valuable woods, particularly teak and juniper; deposits of coal at the head of Sibuguey Bay and at other places, and gold also is found in the western portion. Pop. 98,078.

ZAMBONI'S DRY PILE, *in electricity,* a dry voltaic pile or battery invented by Zamboni. Paper silvered on one side is damped and coated on the other with manganese dioxide; half a dozen of these sheets being superimposed to save time, discs are punched out, and 1,000 to 2,000 single sheets are compressed in a glass tube with metal caps and knobs at the ends. Such a pile will charge a Leyden jar, though it will not give shocks or sparks.

ZAMIA, a genus of plants of the family *Cycadaceæ.* (See CYCAPALES). In aspect the species partly resemble palms, and partly tree ferns; in affinity they are nearer the latter than the former, but rise considerably above them in organization. They are natives of tropical America, tropical Asia, the Cape of Good Hope, and Australia. The stems of *Z. tenuis* and *Z. furfuracea,* and the seeds of *Z. pumila,* in the West Indies, yield arrowroot. The Florida Indians call the last "coontie," and manufacture flour from the rhizomes. It grows in the everglades of Florida, and has large tubers of the shape and size of parsnips, which are rough and gray on the outside, but are white internally. The tubers are pounded to a pulp, in a log mortar, and washed in a straining cloth, the abundant starch of the coontie passing through and settling in a deerhide. This process rids the plant of an acrid poisonous principle which is carried away by the water. The Federal armies lost a number of men during the Civil War, who ate the root in its crude poisonous state. The sediment, or starch left in the deerskin after straining, is fermented and dried, and becomes a yellowish-white flour ready for use, which has long been a staple food of the Seminoles. The coontie starch, when extracted in proper mills, is finer and whiter than the

Indian product, and is called Florida arrowroot. It is nutritious, and makes excellent puddings, and the like.

ZAMOJSKI, zä-moi'skē, **ZAMOYSKI**, or **ZAMOSC**, an ancient family of Poland, whose most distinguished members have been JAN ZAMOJSKI, statesman and general: b. Skokow, palatinate of Chelm, 1 April 1541; d. near Skokow, 3 July 1605. He was educated at Paris, Strassburg and Padua, and in 1564 was elected rector of the university at Padua. In 1565 he returned to Poland, and upon the death of King Sigismund Augustus in 1572, succeeded in so organizing the equestrian order, that in the diet of 1573, held at Warsaw, Henry of Anjou (afterward Henry III of France) was chosen king of Poland. Upon the abandonment of Poland by Henry, a party of nobles elected Maximilian II of Austria, and he was proclaimed king by the primate; but the party hostile to the house of Austria, led by Zamojski, chose Stephen Bathory (q.v.), who marched rapidly to Cracow, and was there crowned. Zamojski was made grand chancellor of the kingdom and became a power in Polish affairs. He was afterward married to Griselda, a niece of the king. In 1580, during the war with Russia, Báthori appointed him commander of the principal army, with the title of hetman; and in 1582 he negotiated the peace by which Livonia, Esthonia and Novgorod were ceded to Poland. After the death of Báthori in 1586, he might have secured the crown for himself; but he used his influence in favor of Sigismund III, son of the king of Sweden, defeated the army of the opposing claimant, the Archduke Maximilian, at Cracow, pursued him into Silesia, and took him and his forces prisoners. From 1590 to 1597 he was engaged in a constant series of wars; and while often at variance with Sigismund, with whom he was no favorite, he remained a dominant figure in the state, fighting successfully against the Turks, Tartars and Cossacks, and oftentimes supporting the army from his private fortune. Zamojski was not only a great statesman and general, but a munificent patron of literature and the sciences. He founded New Zamosc, which came to be regarded as one of the strongest fortresses of Poland, and established there a university and a famous printing press. He wrote 'Testamentum Joannis Zamori' (1606), and many letters of his are to be found in Lunig's 'Literæ Procerum Europæ.' JAN ZAMOJSKI, general, grandson of the preceding: b. 1626; d. Warsaw, 2 April 1665. He participated in the campaign of 1651 against the Cossacks, was made palatine of Sandomir, and was conspicuous in the wars that followed. In 1659 he was at the head of the army which acted in the Ukraine against the tsar of Russia. ANDRZEJ ZAMOJSKI, statesman: b. Biezun, 1716; d. Zamosc, 10 Feb. 1792. He entered the military service of Saxony, returned to Poland in 1754 and was made marshal of the palatinate of Smolensk. In 1760 he emancipated his serfs, and on the accession of Stanislas, Augustus was appointed grand chancellor in 1764, an office he resigned rather than sign the partition treaty. In 1776, at the request of the diet, he drew up a code of laws, which was printed under the title of 'Zbiór praw sadowych' (1778). The liberal character of the code, especially its provision for a general measure of emancipation, aroused against it so great a hostility, that in the diet of 1780 it was not permitted to be read, but it was adopted in 1791. ANDRZEJ ZAMOJSKI, statesman, grandson of the preceding: b. 2 April 1800; d. Cracow, 29 Oct. 1874. He studied at Geneva and Edinburgh, entered the Polish civil service in 1823 and was Minister of the Interior of the revolutionary government in 1831. He later introduced steam navigation on the Vistula, but as the head of an important agricultural association incurred the suspicion of the Russian government. The association was suppressed in 1862. At the request of the viceroy, Grand Duke Constantine, Zamojski drew up a statement of the claims of Poland, a document which displeased the Russian government and caused Zamojski's banishment.

ZAMORA, thä-mō'rä, Antonio de, Spanish dramatist: b. Madrid, about 1660; d. there, before 1744. He was a court officer during the reign of Philip V and also held a secretaryship in the department of Indian affairs. He wrote many dramas which were highly esteemed by his contemporaries, some 40 of which are extant. He imitated the style of Calderon, but rarely attained the poetic beauty of that author. To modern taste his plays are slow and over-loaded with stage directions which were probably necessary in their day, and they lack the brilliant invention of the dramas of Calderon and Lope de Vega. Yet they are the best of their age. The best of his dramas, however, show skilful development of character. Among the most noteworthy are 'Mazariegos y Monsalves'; 'Cada uno es Linaje Aparte'; 'El hechizado por fuerza,' a comedy produced in Spain in modern times; and 'El Convidado de Piedra,' on which is based the libretto of the opera of 'Don Juan.'

ZAMORA, Spain, a city and capital of a province of the same name, 140 miles northwest of Madrid, on a rocky hill on the right bank of the Douro which is here crossed by a fine bridge. It has interesting mediæval buildings, and is the see of a bishop; the cathedral is a Gothic structure, completed about 1174, but partially modernized in the Corinthian and Doric styles. Zamora as a fortified town played an important part in early Spanish history, and it is renowned for the successful defense which it made against the Moors in 939 A.D. Pop. 20,000. The province of Zamora is divided into eight departments and has a population of about 280,000.

ZAMORA, Venezuela, an interior northwestern state bounded by Lara, Miranda, Bolivar and Los Andes. It has not been very much developed and possesses many natural resources. The capital is Barinas. Pop. 36,000. Area of province, 25,212 square miles. Pop. 246,676.

ZAMORA Y CORONADO, ē kō-rō-nä'thō, **José María**, Central American jurist: b. Cartago, Costa Rica, 1785; d. Cuba, after 1846. He was educated in Spain and on his return from there held important judicial and civil posts in both Porto Rico and Cuba. He published 'Registro de la legislación ultramarina' (6 vols., 1844–48), a work of much historical value on account of its being a collection of laws and regulations pertaining to the Spanish-American colonies. For this reason it has been

largely consulted by students of Latin American law and institutions.

ZAMOSC, zä'mösch (Zamostye, in Russian) Russian Poland, a fortified town in the province of Lublin, on the Wieprz, 50 miles southeast of the town of Lublin. It was laid out in 1588 in the Italian style by Jan Zamojski, and all its houses have arcades. Its fine castle, the four churches, the arsenal, and the townhouse are the chief buildings. The manufacture of furniture is the principal industry. Pop. 16,000.

ZAMOUSE, zä-moos', the West African short-horned buffalo (q.v.).

ZAMPA, zäñ-pä, Ou la Fiancée de Marbre, an opera comique by the French composer, Louis Joseph Ferdinand Hérold (q.v.), first produced in 1831.

ZAMPIERI, dzäm-pē-ā'rē, Domenico. See DOMENICHINO.

ZANARDELLI, dzä-när-dĕl'lē, Giuseppe, Italian statesman: b. Brescia, 29 Oct. 1826; d. Modena, 20 Dec. 1903. After study at Pavia, he was a volunteer in the war of 1848, then was for a time in journalism and gave lectures on law, but was forced by the Austrian officials to discontinue them. Elected deputy in 1859, he held various administrative posts, in 1876 became Minister of Public Works, and in 1878 of the Interior. From 1881 to 1883 he was Minister of Justice, and from 1887 to 1891 again held that portfolio. During the latter period of service he issued the penal code and began a reform in the magistracy. He was president of the Chamber of Deputies in 1894, in 1896 was again chosen, in December 1897 accepted the portfolio of justice for a third time, but withdrew in May 1898, once more to become president of the Chamber. This post, too, he relinquished, to identify himself with the opposition, and at the fall of the Saracco Cabinet in February 1901 was able to form an administration with the aid of the extreme left. He was an orator of high rank, a steadfast Liberal, and the recognized leader of the constitutional left. Failing health prompted his resignation 2 Nov. 1903, shortly before his death.

ZANDEH, zän'dā. See NYAM-NYAM.

ZANE, zān, Ebenezer, American pioneer: b. Berkeley County, Va., 7 Oct. 1747; d. Wheeling, W. Va., 1811. Of Danish descent he made the first permanent settlement on the Ohio River in 1770, on the site of the present city of Wheeling, building there a block house called Fort Henry, whence he repelled several Indian assaults during the Revolutionary War. He was a disbursing officer under Lord Dunmore; held several military and civil offices, and attained the rank of colonel. The land where the city of Zanesville, Ohio, now stands, formed a portion of his property, and he assisted his brother Jonathan and John McIntire in laying out that town in 1799. The locality was called by them Westbourn, and the present name was not adopted till 1802.

ZANELLA, dzä-nĕl'lä, Giacomo, Italian poet: b. Chiampo (Vicenza) 9 Sept. 1820; d. Vicenza, 17 May 1888. After studying for the priesthood at the Vicenza Seminary, he became professor there of philosophy and Italian literature. Having held posts in lyceums at Venice, Vicenza and Padua, he was made professor of Italian literature in the University of Padua in 1866, and in 1871–72 was rector of the university. His work is noted for beauty of style and mastery of form; his most popular poem being 'La Conchiglia Fossile' (The Fossil Shell). His first volume of poems, 'Verses,' appeared in 1868, and was followed by several others. Among his poetic tales are 'The Little Calabrese' (1870), and 'Robin Redbreast' (1881). He published also some volumes of prose, including 'On Italian Literature in the Last Century' (1885).

ZANESVILLE, Ohio, city and county-seat of Muskingum County, at the confluence of the Muskingum and Licking Rivers, 60 miles east of Columbus, on the Baltimore and Ohio, the Pennsylvania, the Zanesville and Western, the Wheeling and Lake Erie, the Ohio River and Western, and several electric railroads. The town was founded by Ebenezer and Jonathan Zane and John McIntire in 1799; it was capital of the State in 1810–12; was incorporated as a town in 1814; and received its city charter in 1850. There are seven bridges crossing the Muskingum and two across the Licking River, the town being built on the banks of the two rivers. The Muskingum is made navigable for small vessels by means of a series of locks and dams, and the city thus has water communication with Columbus; and with Cleveland by means of the Ohio Canal. The city is situated in a fertile agricultural region which has also deposits of coal, clay and limestone. Manufactures were early attracted by the abundant water power supplied by the two rivers and by cheap fuel; they consist of important tile works, potteries, brickyards, tanneries, machine shops, foundries, bent-wood works, tube works, flour and woolen mills, and glass, coffin and mining-tool factories. The chief buildings include the Soldiers' and Sailors' Monumental Building, the County Courthouse, the City Market House, and excellent banking and fraternity buildings. There is a well-organized city school system, both Roman Catholic and Lutheran parochial schools, a business college, high school and Roman Catholic Academy. The McIntire Children's Home was endowed by the estate of John McIntire, and the John McIntire Public Library received a $50,000 Carnegie endowment. The city owns its waterworks, and has a municipal hospital. The commission form of government is in force. Pop. (est.) 33,000.

ZANGWILL, Israel, British author: b. London, 14 Feb. 1864. He was educated at the Jews' Free School, 'Spitalfields,' and the University of London, published in 1888 'The Premier and the Painter,' a fantastic romance, in 1890 established *Ariel, or the London Puck*, a brilliant but short-lived periodical, and soon made his reputation by his essays, works in fiction, and plays. His department of literary causerie, 'Without Prejudice,' in the *Pall Mall Magazine*, became well known in Great Britain for its able critiques. Some of these essays were gathered into a volume of that title in 1896. Some of Zangwill's best fiction deals with Jewish types and subjects, as in 'Dreamers of the Ghetto' (1898), with its semi-historical pictures of Heine, Spinoza, Uriel (Gabriel) Acosta and others. He lectured in Great Britain, Ireland,

Zanthoxylum is called yellow-wood, *Z. caribæum* being differentiated as the prickly yellow-wood. It is a tree, 20 to 50 feet high, whose prickly young stems are made into walking-sticks. The wood is used for inlaying and for furniture. *Z. cribrosum* is the satin-wood of the West Indies, which when first cut has the odor of the veritable satin-wood. *Z. fagara* is a small tree common in the same region, and tropical America, producing a hard, heavy, reddish-brown wood known as savin or iron-wood or as the wild-lime. Still another species is *Z. emarginatum*, a shrub with coriaceous foliage, exported under the name of rose-wood, but called licca-tree or lignumvorum at home. The commonest species of the northern United States and the hardiest is *Z. americanum*, a shrub or small tree, with odd-pinnate leaves, and twigs which are generally prickly. The cymose flowers are axillary and sessile, without calyx, and they are greenish-white. The capsules are black and ellipsoidal. It is called prickly-ash or toothache-tree, because both Indians and country people used the hot, acrid bark of both this species and *Z. clava-herculis*, which when chewed produces a stinging sensation, for aching teeth. The bark of both these species, and the capsules of the latter, are a powerful stimulant and tonic drug. The southern prickly ash, *Z. clava-herculis*, the sea-ash, or pepper-wood, has its flowers in large terminal compound cymes, and its prickles are supported on corky cushions.

ZANZALIANS. See JACOBITES.

ZANZIBAR, zăn-zĭ-bär′, East Africa, (1) A sultanate comprising the whole coast between Magdishu (Magadoxo), about lat. 2° N., and Cape Delgado, lat. 10° 42′ S., with the four islands of Zanzibar, Pemba, Lamu and Mafia. The continental part of the sultanate in 1890 was divided between British East Africa and German East Africa; while the island and town of Zanzibar, and the island of Pemba became a British protectorate; in the course of the European War the German territory was taken by the Allies late in 1917. Joint area, 1,020 square miles; pop. est. 250,000. (2) The island of Zanzibar, with an area of 640 square miles, is 47 miles long and 20 miles wide. It is partly of coralline formation. Its forests have disappeared but its flora is abundant and of great variety. Its fauna is chiefly continental. The island is very fertile and well cultivated, being especially suited for the cultivation of cloves, sugar, coffee, cocoa and various spices, of which there is a considerable export. There are more than 60,000 acres planted to cloves, and there are extensive plantations of rubber and chile. Copra also is an important export. Roads are excellent and an American railway traverses the island. The abolition of slavery was accomplished gradually, beginning in 1897, when it was decreed that no child could be born a slave, and provision for slaves obtaining freedom was made. The process was completed in 1908 and was notably successful in its avoidance of upsetting economic conditions or offending the Moslems. The heterogeneous population estimated at 176,000 includes Europeans, Arabs, half-caste Portuguese from the Malabar Coast of India, and the Suahilis from the mainland. (3) Zanzibar, the chief town (pop. 55,750) on the west side of the island, is the centre of trade for the eastern seaboard of Africa, and of missionary and exploring work for the interior. The city is connected with all parts of the world by cables and is a regular port of call for steamships plying between India and Europe. Direct steamship communication was established with London in 1910. The commerce of the islands is largely in the hands of East Indians, of whom there are about 10,000; while the Arabs, also numbering about 10,000, are the principal landlords. European residents number less than 300. Both its exports and imports amount to more than £1,000,000 annually. The government is practically British.

ZAPATA, Emiliano, Mexican agitator and revolutionary leader: b. state of Morelos, about 1869. He became known as a political agitator during the Diaz régime and was banished to Quintana Roo, but he later returned to his native state. In 1910, at the time of the Madero insurrection, Zapata fought independently against Diaz, in the hope of personally setting up a government. He formulated a scheme for an agrarian reform known as the Plan of Ayala, and when it was refused by the new leaders in Mexico he fought in turn against Madero, Huerta and Carranza. He was in possession of the capital for short periods in March and April 1915, and subsequently, in command of an army of about 10,000 men, he conducted a harrying warfare in the neighborhood with the purpose of establishing a government of which he would be the head.

ZAPOLYA, zä′pŏl′yŏ, John, king of Hungary: b. about 1487; d. 1540. After the death of Louis II at Mohács (1526) he was elected king of Hungary by the National party, having previously been voivode, or prince, of Transylvania. The crown was contested by Ferdinand of Austria, who was at first so successful as to compel Zapolya to flee to Poland. But the latter, with Turkish assistance, by 1529 had subdued a great part of Hungary, together with the capital city of Buda, as well as Transylvania. The kingdom was divided between Zapolya and Ferdinand in 1538 by the treaty of Grosswardein.

ZAPPI, Giovanni Bastista Felice, jō-vän′nē bä-tēs′tä fä-lē′chā zäp′pē, Italian poet: b. Imola, 18 March 1667; d. Rome, 30 Aug. 1719 after a legal training at Bologna, he went to Rome, where he gained a brilliant reputation as jurisconsult and poet. He assisted in establishing the Academy of Arcadians, in which he held the name Tirsi Leucasio. His verse abounds in fantastic adornments. A collection of it appeared in 1776, and it has been otherwise published, both separately and in association with that of his Arcadian colleagues. He received the patronage of Pope Clement XI.

ZARA, zä′rä (Ital. *dzä′rä*), Austria, a seaport town, capital of Dalmatia, on a promontory, which was converted into an island by cutting through the narrow isthmus which formerly connected it with the mainland, 70 miles northwest of Spalatro. It was a fortress till 1873, and still has four gates and mediæval ramparts, the latter now converted into a public promenade. It has steep and narrow streets; several squares; a fine Roman triumphal arch; an

versity of Warsaw and after leaving there traveled extensively through Europe and North America. He has published 'Porydia' (1734); 'Epigrams' (1735); 'Lucie,' a poem (1739), etc.

ZEA, thā'ā, **Francisco Antonio**, Colombian naturalist and statesman: b. Medellin, New Granada (Colombia), 21 Oct. 1772; d. Bath, England, 28 Nov. 1822. After study at the College of Popayan, he was connected with the botanical expeditions of Mutis, in 1795 was sent to Spain under arrest on the charge of circulating republican literature, and though acquitted in 1799 was forbidden to return to New Granada. He carried on botanical researches in Europe, but in 1815 joined Bolivar at Jamaica. In 1819 he was chosen vice-president of Colombia by the congress of Angostura, and in 1820 went to Europe as envoy of the Colombian republic to France and England. He has sometimes been styled the "Franklin of Colombia." Among his published works are 'Memoria sobre la Quina según los Principios de Mutis' (1800), and a 'Historia de Colombia' (1821).

ZEA, zē'ą. See CEOS.

ZEALAND, zē'land, or **SJELLAND**, Denmark, the largest island of the kingdom, between the Cattegat and the Baltic, separated from Sweden by the Sound and from Funen by the Great Belt; it is 82 miles long by 68 miles wide and very irregular, its area being 2,636 square miles, including the two islands Möen and Samsöe, 2,793 square miles; it is three miles from Sweden and 11 miles from Fünen. It has no mountains; but the surface is finely variegated, having small hills and fields of a fertile soil, intersected by canals. It produces large crops of corn, and has excellent pasture. Besides several other towns of considerable importance, it contains the fortress of Elsinore or Helsingör, and the capital and royal residence, Copenhagen. Pop. about 1,096,897.

ZEALAND, or **ZEELAND**, Netherlands, a province bounded south by Belgium, west by the North Sea, east by North Brabant and northeast by South Holland; area, 690 square miles. The capital is Middleburg, in the island of Walcheren; principal seaport town, Flushing. The province consists of a low-lying tract of land on the frontiers of Belgium and on the southern shore of the estuary of the Schelde, and of the islands of Walcheren, North and South Beveland, Schouwen, Tholen, etc., separated from each other and from the mainland by arms of the Schelde, from which and from the North Sea it is protected by dikes. As a whole the province is flat and fertile, producing excellent crops of the ordinary cereals, a considerable quantity of clover, rape and madder, and a superabundance of excellent fruit. The grass lands also are rich and extensive. The climate is rather moist, but comparatively healthful. Large tracts partially covered by the sea have in recent times been successfully reclaimed. Pop. 236,149

ZEALOTS (Greek, *zelotes*, enthusiasts, followers and strong supporters), a sect of the Jews, composed of the more fanatical elements opposed to Roman rule. They led a revolt against the Romans in 6 A.D., and after that frequently robbed and murdered those whom they knew to be supporters of or sympathizers with the Romans. Felix tried to suppress them by crucifying all of the sect whom he could capture, but this only caused an increase in the number of their acts of violence. They continually stirred up the Jews against the Romans, and were largely influential in bringing on the Jewish War of 66–70, which resulted in the overthrow of Jerusalem.

ZEBALLOS, thā-bāl'yōs, or **CEBALLOS**, **Pedro** (ZEBALLOS CORTES Y CALDERON), Spanish general: b. Cadiz, 29 June 1715; d. Cordova, 26 Dec. 1778. Entering the army as a cavalry captain in 1738, he became a lieutenant-general in 1755 and was dispatched to Buenos Aires as governor the next year. On the outbreak of the war with Portugal and England in 1762 Zeballos besieged the Portuguese port of Colonia de Sacramento, near the entrance of the Uruguay River, forcing its surrender 2 Nov. 1762, and capturing 26 English ships in its harbor. He returned to Spain in 1767 and in 1777 was made viceroy of the newly established viceroyalty of La Plata. On his way thither he wrested Santa Catharina from the Portuguese and retaking Colonia de Sacramento, which had reverted to Portugal since its former capture, destroyed it. He was relieved of his duties in 1778 and returned to Spain where he died shortly after his arrival.

ZEBID, zē-bēd', Arabia, a town in Yemen, on the inland route from Hodeida to Mokha, 60 miles north of the latter. It was formerly the seat of a long line of princes, and was famous for its commerce and learning. In the neighborhood are ruins of ancient cities. The population has dwindled to 9,000 inhabitants.

ZEBRA, the name of several animals, natives of Africa, belonging to the family of the horses. The zebra belongs to the same general type as the ass, distinguished from *Equus* (the horse) proper by smaller size and by having the body more or less banded black upon yellowish. The forelegs only possess the "warts," seen in both fore- and hind-legs in the horses; and the tail is "tufted." The typical or mountain zebra (*Equus zebra*) inhabits South Africa, but it is now almost extinct. A few specimens, however, are strictly preserved in the mountainous districts of eastern Cape Colony, where, until about 1875, they abounded in herds on the plains. The body is cream-colored, its characteristic bands being deep black. The stripes are drawn at right angles to the axis of the body. The legs are striped right down to the hoof, but the under part of the body has no stripes. The neck bears a faint development of skin or dew-lap, and the mane is very short. The animal was long considered untamable, but experiments made since 1872 have shown that with proper treatment it can be made to work well in harness. Any general utilization and improvement of it, however, seems impracticable. The dauw, or Burchell's zebra (*Equus burchelli*), is higher and more graceful than the true zebra and is the one commonly seen in menageries. Its stripes are narrower and somewhat differently disposed from those of the true zebra, and extend under the belly, but are absent from the lower part of the legs. It has been

driven northward, and is now rare even in the Transvaal. Chapmann's zebra (*E. chapmanni*) is another variety, found from Bechuanaland north to the Sudan. Grévy's zebra (*E. grevyi*) is restricted to Abyssinia and Somaliland. The quagga (q.v.) is a near ally of the zebras. Consult Lydekker, 'Royal Natural History' (Vol. II, London 1895); Tegetmeier and Sutherland, 'Horses, Zebras, Mules and Mule-breeding' (London 1895).

ZEBRA PARRAKEET, an Australian or East Indian parrot. See BUDGERIGAR.

ZEBRA-SHARK. See TIGER-SHARKS.

ZEBRA WOLF, an early colonial name for the wolf-like, striped, predatory marsupial of Tasmania. See DASYURE.

ZEBRA WOOD, *in botany* and commerce: (1) A kind of wood imported from South America, and used by cabinet makers, produced by *Connarus guianensis* (*Omphalobium lamberti*), a large tree belonging to the natural order *Connaraceæ*, and growing in Guiana. Its colors consist of brown on a white ground, clouded with black, and each strongly contrasted, thus somewhat resembling the skin of a zebra. It is also called pigeon wood, and is used for furniture. (2) The wood of *Eugenia fragrans*, variety *cuneata*. It is a shrub about eight feet high, growing in Jamaica. (3) The wood of *Guettarda speciosa*, an evergreen tree 25 feet high, with scarlet-colored flowers, growing in the East Indies.

ZEBU, zĕ-boo' or thā-boo,' Philippines. See CEBU.

ZEBU. See INDIAN HUMPED CATTLE.

ZEBULUN, zĕb'ū-lŭn, or **ZEBULON,** the 10th of Jacob's 12 sons, and the sixth and last by his wife Leah (Gen. xxx, 19–20). Of his individual history nothing is related in the Scriptures, but his name was given to one of the 12 tribes of Israel, and to a region of Palestine. At the time of the exodus from Egypt the tribe of Zebulon moved in the van, following the tribes of Judah and Issacher. The territory of the tribe lay in the fertile hilly country to the north of the plain of Jezreel, and included Nazareth. The tribe of Zebulon was inferior in importance to several of the other tribes and its tribal existence closed when Tiglath-Pileser carried its principal members, with the northern tribes, into captivity (2 Kings xv, 29).

ZECH, Frederick, American pianist and composer: b. Philadelphia, Pa., 10 May 1858. Taken to San Francisco when very young, he began to study music there and afterward studied in Berlin, 1877–82. Since the year last named he has resided in San Francisco, where he has been conductor of the symphony orchestra and has given many piano recitals. Among his many compositions are four symphonies, four concertos for piano and orchestra, a concerto for violin, one for 'cello; two string quartettes; three sonatas for violin and piano; two for clarinet and piano, one sonata for 'cello and piano, one for flute and piano; several symphonic poems: 'The Eve of Saint Agnes,' 'The Raven'; 'Lamia' after Keats, and 'The Wreck of the Hesperus' after Longfellow; operas 'The Cruise of the Excelsior' and 'Wakinyon,' a North American Indian Opera, sonatas and songs.

ZECHARIAH, zĕk-ą-rī'ą, the 11th in order of the Hebrew writers known as minor prophets. Little is known of his personal history, but he first publicly discharged his office as priest in the second year of Darius 519 B.C. He is called in his prophecy the son of Berechiah and the grandson of Iddo, but in the Book of Ezra (v, 1; vi, 14) he is termed "the son of Iddo." He was priest as well as prophet and is associated with the prophet Haggai. Tradition states that Zechariah had much to do in furnishing the liturgical services of the temple, and in the Septuagint and Vulgate versions several psalms are attributed to him. He deals in his prophecy with the same objects as occupied the mind of the prophet Haggai. His style is characterized by symbolic vision and dramatic action. It is distinctly Apocalyptic. This form of prophecy never predominated until after the Exile and seems to have constituted an element in the last and most powerful appeal made by the mouthpieces of Jehovah to the heart and conscience of His people.

Contents of the Prophecy.— The great portion of the Book consists of a series of visions intended to represent grounds for national confidence and to encourage national effort. The prophecy opens with an exhortation to repentance and a warning against neglect of the prophet's word. The remainder of the book consists of two sections. The first section runs from chapters i to vi.

Ch. i, 15, contains nine symbols, mostly visions, accompanied by their interpretations.

Ch. i, 8–17, a vision of the horses of Jehovah, which, as His messengers, report to Him; along with His reply.

Ch. i, 18–21, four horns, representing the opponents of Israel, are broken.

Ch. ii, a man with a measuring-line lays out the restored Jerusalem.

Ch. iii, Joshua, the high priest, is accused by Satan, and acquitted, and is honored with commissions and revelations from Jehovah.

Ch. iv, the beautiful symbol of the golden candlestick and two olive trees, with the practical application of encouragement to Zerubbabel.

Ch. v, 1–4, a flying roll recording a curse upon immoral actions.

Ch. v, 5–11, an ephah measure containing a woman is seen carried away to Babylon.

Ch. vi, 1–8, four chariots, each having horses of a particular color, are the four heavenly spirits charged to carry out God's purposes in the earth.

Ch. vi, 9–15, the symbolical action of crowns of silver and gold being made and placed upon the head of Joshua the high-priest, who thus represents the Messiah-priest upon His throne.

The second section runs from chapters vii to xiv. In ch. vii the prophet, in answer to a question as to observance of a certain fast, replies that the true fast is justice, mercy and piety, which had been so much neglected in earlier generations. This suggests, in ch. viii, the coming Messianic time, when the city shall be populous and happy under the renewed protection of Jehovah, and the fasts shall be joyful

feasts, attended by multitude of strangers seeking His favor.

There is so much that is matter of dispute in ch. ix–xiv, as regards their date and immediate application, that we shall have to content ourselves with a summary and a few general remarks. The contents are largely symbolical and figurative. Ch. ix–xi, form a division by themselves, perhaps written by the Zechariah of Isa. viii, 2. It has an entirely different historical setting from that of ch. i, 8. Here we are transported back to the 8th century B.C. Ch. ix, 1–8, refers to conquests made by Tiglath-pileser III (745–727 B.C.). Northern Israel is still in existence, and Assyria is still in its "pride" (x, 10ff). These allusions form part of the very texture of the prophecy, and are assumed by some to be old fragments embedded in a post-Exilic work.

Ch. ix, 1–8, Syria, Phœnicia and Philistia are to be brought low. Yet a remnant of the Philistines shall be united with Judah, and both shall be under the protection of Jehovah. Ch. ix, 9–17, the Messiah shall come as the Prince of Peace to restore the dispersed of Israel, and save them from their enemies. Ch. x, the people are entreated to turn to Jehovah in their troubles, and not to diviners and images. Jehovah will be the defender alike of Judah and Israel, restoring and strengthening them and bringing low their oppressors. Ch. xi announces the shock of war which appals the rulers of Judah (ver. 1–3). The rest of the chapter is allegorical. It represents Jehovah as rejected by His people, they being in turn rejected by Him, their true Shepherd. By an expressive figure, the brotherhood of Judah and Israel is declared to be broken. Ch. xii, 1 to xiii, 6, the nations come against Jerusalem; but Jehovah defends and saves it. The conflict is shown to be spiritual, for a spirit of grace and supplication is to be poured upon Judah and Jerusalem. Also a fountain is to be opened for the cleansing of guilt, and the idols and false prophets are to be banished. Ch. xiv — Again Jerusalem is besieged, and this time it is taken, half the people going into exile; but the residue are saved. After various figurative illustrations of the processes and results of the Messianic reign, it is declared that the survivors among the nations shall go up to worship in Jerusalem, which shall be wholly consecrated to Jehovah.

ZECHARIAH, Book of. One of the generally accepted results of Biblical criticism is the conclusion that Zechariah i–viii are the work of the prophet whose name they bear, but that the remainder of the book, chapters ix–xiv, was written by another author or authors. The reasons for this conclusion will be given later. The first part, chapters i–viii, will be discussed by themselves, followed by a consideration of the remaining chapters.

Zechariah the prophet is doubtless to be identified with Zechariah the priest of Nehemiah xii, 16, see also xii, 4. He was probably the son rather than the grandson of Iddo, see Ezra v, 1, vi, 14, the phrase "the son of Berechiah" in Zechariah i, 1 being a later addition, resulting from a confusion with Zechariah the son of Jeberechiah mentioned in Isaiah viii, 2. The evident interest of Zechariah in the temple is in accord with his priestly descent. But his general outlook is more prophetic than priestly, as in the case of the other priest-prophets, Jeremiah and Ezekiel. Zechariah doubtless returned from the exile in the company of Zerubbabel along with his father, Iddo, Nehemiah xii, 1–4.

These chapters are given precise dates, in the years 520–518 B.C. The historical circumstances of that time are well known. The return from the Babylonian exile under Zerubbabel had taken place some 16 years before. A beginning of the rebuilding of the temple had been made at that time, if the data are historical, but it is evident that little progress had been made. The people became discouraged, they were few in numbers, surrounded by enemies, with precarious conditions of existence. The attempt to rebuild the temple was soon given up, and the people resigned themselves to a discouraged selfish life. Haggai began his prophetic ministry in 520, endeavoring to encourage the people to rebuild the temple. His message centred about this thought, accompanied by denunciation of the people for their sins and indifference. About two months later came the first message of Zechariah. Both prophets speak as if there had been no return from the exile in any true sense. The return announced in prediction, especially by Deutero-Isaiah, was to be a glorious return, accompanied by signal manifestations of the power of Yahweh. Such a return had not taken place. Zechariah speaks of the people, therefore, as still in captivity, and the return as yet of the future. Zechariah continues and amplifies the work of Haggai. His specific object is the rebuilding of the temple, but he seeks the attainment of this end by a presentation of the glorious future in store for the nation.

There are probably no important later additions in these chapters. iv, 6b–10a is probably by Zechariah, but does not belong in its present position where it interrupts the connection. The meaning in vi, 11–13 has been obscured by textual corruption, which will be considered later.

Chap. i, 1–6 is a hortatory introduction, dated in 520. The main part of the collection consists of i, 7–vi, 15, bearing the date of 519 This is made up of eight visions and their interpretations, with an appendix. The interpreter is an angel, a feature original with Zechariah. The first three visions, i, 7–ii, 13, present various features in the coming return from the captivity; iii–iv, except iv, 6b–10a, deal with the two leaders of the people, Joshua the priest and Zerubbabel the Davidic prince, teaching the removal of the guilt of Joshua and of the nation and the divine favor which will attend both these leaders; v, 1–vi, 8 contain three visions, dealing with the purification from sin of the restored people. vi, 9–15 contains a historical appendix to the visions. This predicts, in accord with Haggai, that Zerubbabel is to be manifested as the Messiah, rebuilding the temple and bringing deliverance to the people, while Joshua is to be closely associated with him. The principal place, however, is occupied by Zerubbabel. Verse 11 doubtless originally mentioned only one crown, for Zerubbabel, this being required by the con-

text. How the verse originally read is a question; perhaps the latter part should be omitted. In verse 13 the phrase "and he shall be a priest upon his throne" should be read "and there shall be a priest upon his right hand," with the Septuagint. The changes in the text as it now is were doubtless intentional, introduced later when it was seen that Zerubbabel was not the Messiah. For the interpretation here given compare verse 13 with iv, 8. Chaps. vii–viii give an account of the visit of men of Bethel to the prophet with inquiries concerning fasting, with special reference to the fast commemorating the destruction of Jerusalem. The prophet answers that the future will be a time of joy and rejoicing rather than of fasting and sadness.

The thought of Zechariah shows much similarity to that of the earlier prophets, with which he is evidently familiar, and his phraseology also shows the impress of their influence. He demands faithfulness to Yahweh and the observance of ethical standards, in accord with the highest teaching of the pre-exilic prophets.

The activity of angels is specially prominent in these messages of Zechariah. The superhuman adversary, Satan, also appears here for the first time, iii, 1–2.

There are practically no resemblances between chapters ix–xiv and i–viii, while there are many differences. The first chapters, those of Zechariah, are precisely dated, the second part has no dates; the first part has visions, the second not; the first part makes the temple especially prominent, it is hardly alluded to in the second part; the first part reflects the Persian period, the second part has no certain references to it; and the peaceful outlook of the first part has become warlike in the second part, and is characterized, in certain portions, by a bitterness of feeling toward other nations hardly paralleled elsewhere, see ix, 1ff, 13ff, xii, 1ff, etc. The nations mentioned are not those of the Persian period, Hadrach and Damascus, ix, 1, Hamath, ix, 2, Greece, if the text is correct, ix, 13, and Assyria and Egypt, x, 10. The Messianic picture of the second part, ix, 9–10, is the ordinary one of a Messianic king of the future, his reign in this case to be preceded by the destruction of enemy nations, in contrast with Zechariah's conception of Zerubbabel, the prince already present, as the Messianic king, himself bringing deliverance.

The question to what period chapters ix–xiv belong has been much disputed, which is also true of the further question whether they are the work of one author, or of more than one.

The following features are claimed to be references to a pre-exilic situation. The northern kingdom, it is said, is still in existence, ix, 10, 13; xi, 14; Egypt and Assyria are contemporary nations of the writer, x, 10f; idolatrous conditions, 10, 1f, are thought to indicate this period; and the nations mentioned with threats, ix, 1–7, are said to be those of this time, see Amos i, 3–10. The pre-exilic date usually assigned is about the time of Amos.

There is a growing tendency, however, to assign these chapters to the time after the exile, and usually to the Greek period. Little dependence can be placed on the mention of the Greeks as a present power, ix, 13, for there is considerable reason to think that these words may be an addition. The nations which are here denounced were prominent during the time of conflict between the Seleucidæ of Syria and the Ptolemies of Egypt. Egypt and Assyria, on this view, designate the Ptolemies and the Seleucidæ; such a usage probably has parallels elsewhere, as in Micah v, 5f, which at least uses the term Assyria after Assyria had passed away. These chapters contain evident allusions to the captivity, ix, 11f, x, 6–9. There is no reference to a Davidic king as reigning in Jerusalem, the Davidic family being like the other noble families, xii, 7, 12ff. The general character of the message is not like that of pre-exilic prophecy, it has characteristics which are usually called apocalyptic, found in Ezekiel xxxviii–xxxix, Joel iii, Isaiah xxiv–xxvii, etc. These characteristics are partly vagueness and obscurity; in part the form of presentation of the future, the nations are to attack Israel and Yahweh is to destroy them; and especially the great extravagance of representation, found particularly in chapter xiv. The priestly tone, manifesting itself in the great emphasis upon the externals of worship and upon holiness, is also a mark of the later time.

The inconclusiveness of some of the arguments given above for a pre-exilic date has already been noted. Further, the mention of the northern kingdom is not out of harmony with the postexilic period, for a return of Ephraim along with Judah was a part of the prophetic expectation, see Ezekiel xxxvii, 16ff. Idolatry is not unknown after the exile, contrary to the view often maintained, see Malachi iii, 5.

The indications which have been mentioned point to the Greek period for chapters ix–xiv. There are many obscurities in these chapters, so that the interpretation is not always certain. But there are variations in the representation which make it probable that these chapters are not entirely the work of one author, or of entirely the same period. Especially to be noted is the optimistic tone in ix, 11–xi, 3, in which the restoration of the people from captivity under favorable national conditions is indicated. In xi, 4–17, xiii, 7–9, however, the tone is one of pessimism. Here severe oppression by their captors has aroused intense bitterness toward them. Such oppression seems to have characterized the reign of Ptolemy Philopator, 222-205 B.C., after the battle of Raphia, 217 B.C. These portions, therefore, seem to have been written after 217 B.C., while the more optimistic portions are somewhat earlier under more favorable conditions. It may be that the earlier portion includes all of ix, 1–xi, 3, and the later xi, 4–xiv, 21. But it is also quite possible that there are more than two authors.

In the whole of chapters ix–xiv the principal thought is the future expectation of the nation. In the first part it is a message of hope and national restoration, accompanied by punishment of the enemies. In the second part there is a note of discouragement, finding expression in bitterness against the oppressors. The destruction of these oppressors is portrayed with expressions of hate in chapter xiv. The ethical teaching concerning the present-day conditions, so characteristic of the earlier prophets and of Zechariah himself, is not found here. The hope for the future of

the nation is principally in Yahweh's manifestation of his power against the nations, rather than in the co-operation of the nation with God.

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ZEDEKIAH, zĕd-ĕ-kī'ą, the last king of Judah of the line of David. He was the third son of Josiah and Hamutal and his name was originally Mattaniah. At 21 he was appointed by Nebuchadnezzar to succeed his nephew Jehoiachim (whom he had carried to Babylon) as king of Judah about 579 B.C., and changed his name to Zedekiah. He reigned in Jerusalem 11 years. He took an oath of allegiance to Nebuchadnezzar, which he afterward broke, and entered into a league with Egypt against him. His action in so doing was denounced by the prophet, Jeremiah, who, as well as Ezekiel, then in Chaldæa, predicted the approaching fall of Jerusalem. Jerusalem was besieged by Nebuchadnezzar and taken in 588 B.C., after a siege of a year and a half, the temple and city destroyed, and the leaders of the Jews carried captive. Zedekiah, whose sons were killed in his presence, had his eyes put out, and was carried in fetters of brass to Babylon, where he died, but the time of his death is unknown. His history is recorded in the books of Kings and Chronicles, and more fully in Jeremiah.

ZEDLITZ, tsĕd'lĭts, **Josef Christian,** BARON VON, Austrian poet: b. Johannisberg, Austrian Silesia, 28 Feb. 1790; d. Vienna, 16 March 1862. He served in the Austrian army at the battles of Regensburg, Aspern and Wagram, and afterward entered the service of the Austrian foreign-office. His dramas, 'Der Stern von Sevilla' (1830); 'Kerker und Krone' (1834), etc., were long popular, but he is best known by his pleasing lyrics and ballads, 'Totenkränz,' a collection of elegies (1827); 'Gedichte' (1832); 'Soldatenbüchlein' (1848). He translated into German Byron's 'Childe Harold' (1836).

ZEDLITZ, Karl Abraham, BARON VON, Prussian statesman: b. Landshut, Silesia, 4 Jan. 1731; d. Kapsdorf, Silesia, 18 March 1793. He was appointed Minister of Justice in 1770, and was placed at the head of the department of ecclesiastical affairs and public instruction in the next year. He did much to uphold the liberty of the press and was a leader in the matter of prison reform. He resigned office in 1789.

ZEDOARY, certain species of *Curcuma*, natives of India, China, etc., whose rootstocks are aromatic, bitter, pungent and tonic, and are used for similar purposes with ginger, although less effective. The round zedoary is the product of *C. zedoaria*, having palmate rootstocks, straw-colored within, which are used like turmeric for dyeing. Long zedoary, produced by the same species, has long palmate rootstocks, yellow within. Zedoary is a powerful sudorific and is employed in the Orient in alterative medicines and for incense.

ZEEHAN, zē'hąn, Tasmania, a mining township on the west coast near the base of Mount Zeehan, from which it takes its name, and 29 miles from the port of Strahan on Macquarie Harbor. The township owes its existence to the discovery in 1884 of rich silver-lead ore in great abundance, extending over an area of more than 160 square miles. Pop. 5,014.

ZEELAND, zā'lānt, Netherlands. See ZEALAND.

ZEEMAN, Pieter, Dutch physicist: b. Zonnemaire, Zeeland, 1865. He was educated at the University of Leyden, and was later assistant and lecturer there. From 1900 he was professor of physics at the University of Amsterdam. He discovered in 1896 the phenomenon in light now known as the Zeeman Effect, for which achievement he was awarded the Baumgartner prize at Vienna; the Wilde prize at Paris, and one-half of the Nobel prize in physics in 1902. He wrote 'Messungen ueber das kerrsche Magneto-optische Phänomen' (1893); 'Experimentaluntersuchungen über Teile die kleiner als Atome Sind' (1900); 'Researches in Magneto Optics' (1913), etc.

ZEEMAN, Remigius, Dutch marine painter: b. Amsterdam, about 1609; d. there, after 1673. His real name was Nooms, but he received the name of Zeeman from painting marine subjects. There are a number of his works in the royal palaces at Berlin, where he resided for a number of years and was painter to the Elector Frederick William. He also produced several etchings of more than ordinary merit, among them three of naval battles between the English, French and Dutch, which occurred in 1673. Among his paintings are 'Sea-fight near Leghorn, 14 March 1653' (Amsterdam Museum); 'Seashore with Boats' (Berlin Museum), the very fine 'View of the Old Louvre from the South Bank of the Seine' (Louvre), etc.

ZEEMAN EFFECT, a phenomenon highly important in connection with theoretical physics, discovered in 1897 by Dr. Pieter Zeeman, of the University of Amsterdam. It consists in the doubling (or further multiplication) of the lines of the spectrum of a substance, when the source of the light under examination is placed in a powerful magnetic field. (See SPECTROSCOPY). The results that are obtained under varying conditions are too complicated to admit of full discussion in the present place. In general, however, it may be said that when the ray of light under examination travels in a direction parallel to the lines of force in the magnetic field, each line of its spectrum is separated into two lines, which are collectively known as a "magnetic doublet." The two components of such a magnetic doublet have (in general) the same intensity, and they are circularly polarised in opposite directions. Previous to Dr. Zeeman's discovery, no source of light was known, the rays from which were completely polarised, either circularly or otherwise. In order to observe the Zeeman effect properly, it is essential for the magnetic field to be both intense and uniform, and for the spectroscope to have a high resolving power. An idea of the order of magnitude of the phenomenon may be had

from the following fact: In a magnetic field whose intensity is 10,000 C. G. S. units, each of the two well-known D lines of sodium is resolved into a doublet, and the separation of the constituents of either of these doublets is approximately equal to one-twelfth of the distance between the original D lines.

When a ray of light originating in a magnetic field leaves that field in a direction perpendicular to the lines of magnetic force, the phenomena that are observed are much more complicated. The lines of the spectrum are often observed to be triple, and not infrequently they are quadrupled, or even more complex. In all cases, however, each constituent of the modified line is completely polarized; but the polarization, instead of being circular as before, is new plane. The several constituents into which each primitive line is resolved may, in fact, be divided into two groups, one of which is polarized in a plane parallel to the lines of magnetic force, while the other is polarized in a plane perpendicular to those lines.

It will be observed that the Zeeman effect is due, apparently, to the influence of the magnetic field upon the ultimate molecular mechanism which is concerned in the very genesis of the light-ray; and herein lies its great theoretical importance. The ordinary theories of light treat of the propagation of luminous waves through the ether and through matter, after those waves have left their source; and little is known of the way in which a light-wave originates, at the atom which presumably gives it birth. The phenomenon discovered by Dr. Zeeman enables us to trace the consequences of modifying, by direct experimental means, the ultimate conditions that prevail at the very source of the light; and for this reason it is likely to lead to results of the highest importance with respect to the structure of matter and the nature of the ether and its motions. At the present day, physicists believe that the atoms which constitute matter are themselves composed of far smaller particles called "electrons" (q.v.), the electron, or ultimate unit in the structure of matter, being of the nature of a tiny disembodied charge of electricity. Light is believed to be due to the motions of these electrons within the atoms; and the Zeeman effect is believed to be due to the influence of the magnetic field upon the motion of the electrons. (See LIGHT; ETHER; ELECTRON THEORY; SPECTROSCOPY). For a good account of the main facts, consult Cotton, 'Le phenomène de Zeeman' (Paris 1900). Consult also Lewis, E. P., 'Effect of a Magnetic Field on Radiation' ('Scientific Memoir Series,' Vol. VIII, New York 1903); Zeeman, Pieter, 'Researches in Magneto optics' (London 1913). Reference should also be made to current scientific periodicals, because the subject is being intently studied, and data in connection with it are being rapidly accumulated.

ALLAN D. RISTEEN.

ZEGEDIN, Stephen de, Hungarian Protestant theologian: b. Zegedin, 1505; d. Revin, Hungary, 2 May 1572. He studied under Luther and Melanchthon at Wittemberg, and taught and preached afterward throughout the cities of Hungary; was taken prisoner by the Turks, who treated him with severe cruelty. Among his works were 'Speculum Romanæ Pontificum Historicum' (1602); 'Assertio de Trinitate' (1573); 'Tabulæ Analyticæ in Prophetas. Psalmos, et Novum Testamentum' (1592).

ZEGEDIN, SZEGEDIN, or **SZEGED,** Hungary, city in Csongrad, near confluence of the rivers Maros and Theisse, 100 miles southeast of Budapest and an important railroad junction. It is the second largest town in Hungary and has been practically rebuilt since the inundation caused by the rising of the Theiss nearly destroyed it 11 March 1879. It has fine buildings and handsome squares and boulevards. A dam protects the town from the river. It manufactures paprika, soap, woolens, leather and toys. Being located adjacent to two navigable rivers, it controls the commerce of a large surrounding district. It has been an imperial city since the 15th century and was held by the Turks in 1541–1686. Pop. 118,000.

ZEGERS, zā'gẹrs, or **SEGHERS, Hercules,** Dutch landscape painter: b. about 1589; d. about 1645. He was an artist and engraver of great merit, but notwithstanding the general excellence of his works he found great difficulty in disposing of them, and, becoming discouraged, fell into habits of intemperance. After his death his works sold for very high prices.

ZEGERS, Tacite Nicolas, Flemish theologian: b. Brussels, in the latter part of the 15th century; d. there, 1559. He entered the Franciscan order and in 1536–48 he was professor of theology at Louvain. His works are of high value and he was considered one of the greatest critics of his time. He prepared many volumes of criticisms on the New Testament besides a Latin edition 'Testamentum justa veterem ecclesiæ editionem' (1559).

ZEILA, zā'lą, **ZAYLAH,** or **SELA,** Northeast Africa, a seaport of the British Somali Coast Protectorate, on the Gulf of Aden, 25 miles southeast of Jibutil, the port of French Somaliland. Its former commercial importance as the terminus of caravan routes from Harar and Shoa in Abyssinia has diminished since the construction of a railroad from Jibutil to Harar. Pop. 15,000.

ZEILER, tsī'lẹr, or **ZEILLER, Martin,** German geographer: b. Styria 1589; d. 6 Oct. 1661. He was one of the foremost authorities of his time, and a voluminous writer on various subjects. He wrote the text for many of the long series of works entitled 'Topographia' published by Matthew Merian, who himself engraved the copper plates.

ZEISBERGER, tsis'bẹrg-ẹr, **David,** American Moravian missionary among the Indians: b. Zauchtenthal, Moravia, 11 April 1721; d. Goshen, Ohio, 17 Nov. 1808. Educated in Saxony, he emigrated to Georgia in 1738 and in 1740 went to Pennsylvania, where he was one of the founders of the towns of Bethlehem and Nazareth. In 1743 he became a missionary to the Indians, and labored until the breaking out of the Indian war in 1755 among the Delawares at Shamokin (Sunbury, Pa.), and the Iroquois at Onondaga. In the time of the Pontiac conspiracy, he assisted in ministering to the Christian Indians for whom the governor of Pennsylvania had provided a refuge at the barracks at Philadelphia. Peace having been concluded, he led the remnant of these Indians

to Wyalusing, on the Susquehanna, in Bradford County, Pa. In 1767 he penetrated through the wilderness to Goshgoshunk, on the Allegheny, in Venango County, and established a church among the Monseys. He removed with his flock in 1770 to the Beaver Creek, and began another station, called Friedenstadt, in what is now Lawrence County; two years later he explored the Muskingum region, in the present State of Ohio, and laid out an Indian town, Schoenbrunn, on the Tuscarawas. After a time he was joined by all the Moravian Indians of Pennsylvania, whom the march of civilization drove westward. Two more towns were built, a number of other missionaries entered the field, and many new converts were added. In 1782 the Wyandots fell upon the settlement of the Christian Indians at Gnadenhutten and massacred many of them. This was a death blow to the Moravian mission among the Indians. With a small remnant Zeisberger built an Indian town, in what is now the State of Michigan, but in 1786, at the head of a small band of followers, he returned to Ohio, and in the following year commenced a new settlement, which he called New Salem, in Huron County. In 1791 the hostility of other Indians obliged them to emigrate to Canada, where they founded Fairfield, on the river Thames. In 1798 the United States Congress having granted to the Moravian Indians the tract of land in Ohio upon which they had formerly been settled, Zeisberger returned to that country with some of his converts, and near the ruins of their once flourishing towns established a new station, to which he gave the name of Goshen. There he preached the remaining 10 years of his life. His published works are a 'Delaware and English Spelling Book' (1776); 'A Collection of Hymns in Delaware' (1803); 'Sermons to Children,' in Delaware (1803). In recent years have appeared his 'Dictionary in German and Delaware' (1887); 'Diary of David Zeisberger 1781–98' (1888); and 'Essay toward an Onondaga Grammar' (1888). Consult Schweinitz, 'Life and Times of David Zeisberger' (1870).

ZEISE, tsī'sĕ, **Heinrich**, German poet: b. Altona, Schleswig-Holstein, 19 April 1822. He was an apothecary successively in Altona and Copenhagen, and from 1863 to his retirement in 1875 was proprietor of a chemical manufactory at Altona. He finally settled in Grossflotbek, near Altona. During an extended journey through Norway, Sweden and Denmark, he familiarized himself with Scandinavian literature, and subsequently he translated the writings of Oehlenschläger, Andersen, Holst, Jörgen, Moe and others, and works of natural history by Schouw and Oersted. Zeise's original verse is often careless in diction, but has generally a pleasing quality, and reaches a stirring note in his patriotic songs, many of which are among the more valuable in his collection of 'Deutsche Kriegs- und Siegeslieder' (1864). Among his volumes are 'Reiseblätter aus dem Norden' (1848); 'Gedichte' (2d ed. 1852); 'Neuere Gedichte' (1850); 'Kampf- und Schwertlieder' (1849); 'Kleine Lieder' (1871); 'Aus dem Leben und den Erinnerungen eines Nord-Deutschen Poeten' (1888); and 'Natur- und Lebensbilder' (1892).

ZEISING, tsī'sing, **Adolf**, German writer on æsthetics: b. Ballenstedt (Anhalt), 24 Sept. 1810; d. Munich, 27 April 1876. He wrote 'Neue Lehre von den Proportionen des menschlichen Körpers' (1854); 'Æsthetische Forschungen' (1855); 'Religion und Wissenschaft' (1873); and several works of fiction. For a time he held a professorship in the Bernburg (Anhalt) gymnasium, but after 1853 devoted himself to letters, residing generally in Munich.

ZEISLER, Fannie Bloomfield, American pianist: b. Bielitz, Austria, 1865. When she was two years of age, her family emigrated to the United States and settled at Chicago, where she showed an early aptitude for the piano. Her first teacher was Bernard Ziehn of Chicago, and she studied later under Carl Wolfsohn in this country. In 1878, she went to Vienna where she studied for five years under Leschetizky, and also made her début in 1883. In 1885 she married Sigmund Zeisler, a Chicago lawyer. Until 1893 she played in concerts in the United States; then toured Germany (1893–95), England in 1898, and returned to America for an extended tour in that year. In 1902, she was again in Europe, touring Germany, Austria and France. Since 1903 she has been in the United States, with the exception of one concert tour in Europe in 1912. She is also a prominent member of literary and musical clubs in Chicago. Mrs. Zeisler's playing has met with the greatest praise. Her technique is brilliant and her interpretation is of much intellectual and emotional depth.

ZEITUN, zā-toon', or **ZEITAN**, Asiatic Turkey, a town in the province of Aleppo, 25 miles northwest of Marash, in an iron-mining district, inhabited chiefly by Armenian Christians. The district is fertile but mountainous. The people, distinguished by their martial spirit and their immunity from crimes of violence, are descendants of the Armenian kingdom which existed in Cilicia from the 11th to the 14th century. A sanguinary conflict with Turkish troops soon after the Crimean War drew European attention to the community, and it was stopped by the intervention of the British and French consuls. In 1878, 1890 and 1895 they defended themselves successfully from Turkish oppression, securing favorable conditions of peace. The population suffered greatly from massacres during the European War. Pop. about 20,000.

ZEITZ, tsīts, Germany, a town in the province of Saxony, Prussia, on the Weisse Elster, 23 miles by rail southwest of Leipzig. A gymnasium, and a library in a former Franciscan monastery are among its educational institutions. It is a busy industrial centre with manufactures of woolens, cottons, calicoes, leather, hoisery, mineral oil, sugar, pianofortes, cycles, etc. Pop. 37,000.

ZELA, zē'la, an ancient town of Asia Minor, in the Pontus, where Julius Cæsar defeated Pharnaces, king of Pontus and son of Mithridates, and announced his victory to the Roman Senate, in the famous brief dispatch, *Veni, vidi, vici* — "I came, I saw, I conquered." This battle ended the war; Pharnaces escaped into Bosporus, where he was slain by his lieutenant, Asander; Pontus was made a Roman province, and Bosporus was given to Mithridates of Pergamus, 47 B.C.

(1) of sending the Gospel to the women of India in their own homes by means of female missionaries; (2) of alleviating their sufferings in sickness and ministering to their spiritual need; and (3) of promoting education, based on Holy Scripture, especially among women of the higher classes. See INDIA.

ZEND, more correctly **AVESTAN,** an ancient Iranian language, in which the Zend-Avesta is composed. This language was first introduced to notice by Anquetil Duperron, and the accurate knowledge of it has been developed among others by Rask, Burnouf, Bopp and Haug. It is now recognized to be a coæval and cognate dialect with the Vedic Sanskrit. It embraces two dialects called Bactrian, in contradistinction to the ancient languages of Media and Persia, which are called the Western Iranian, while the Zend or Bactrian dialects are called the Eastern Iranian dialects. The two Zend dialects consist of an earlier and a later, analogous to the Vedic and classic Sanskrit or to the Homeric and classic Greek. The period of transition between them is perhaps from 100 to 200 years. The earlier dialect is called the Gâtha, from the Gâthas or sacred songs which form the only remains of it; the later is that in which the greater part of the Zend-Avesta or Zoroastrian sacred writings are found. They differ both in grammar and pronunciation, they are both highly cultivated languages and rich in inflections, but the earlier is richer in inflections and the later in compounds. The earlier is distinguished by long vowel terminations, probably produced by transcribing the singing pronunciation of the gâthas. The present alphabet is comparatively modern and is probably derived from the Syriac. There are 12 simple vowels, 14 diphthongs and 29 consonants, represented by separate characters. The roots are mostly monosyllabic, some consisting only of a single vowel, others of a vowel and consonant or a vowel between two consonants. These primitive roots are modified by articulate additions, which extend or limit their meaning after the manner of prefixes and suffixes, thus *dâ,* to make, with the addition of *th,* becomes *dath,* to place. Verbal roots undergo modifications producing three distinct forms, the causal, the desiderative and the intensive. Verbs have three voices, active, middle (reflective) and passive; and four moods, indicative, subjunctive, potential and imperative. Some of these moods are double. The tenses include one for the present, four for the past and two for the future. Nouns are formed from roots by means of suffixes. There are three genders, masculine, feminine and neuter. There are also three numbers, singular, dual and plural, with eight inflections in the first and last and five in the middle number. The forms of the declensions closely resemble those of Sanskrit; and there are many other analogies between the Gâtha dialect and the Vedic Sanskrit. See AVESTA; SANSKRIT; SANSKRIT LITERATURE.

ZENGER, John Peter, American publisher; b. Germany, about 1680; d. New York, 1746. He came to America about 1700 and became a printer's apprentice. He began the publication of the New York *Weekly Journal,* 5 Nov. 1733, an organ opposed to the governor and supported by Chief Justice Lewis Morris and other leading men. The paper was credited with greatly influencing public opinion against the government, and Zenger was arrested 17 Nov. 1734 on a charge of publishing seditious libels. He was imprisoned for some time before his trial, at which he was defended by Andrew Hamilton, and his acquittal by the jury was regarded as the first important victory for the freedom of the press. The verdict has been called "the morning star of that liberty which subsequently revolutionized America." Consult Rutherford, 'John Peter Zenger' (New York 1904).

ZENITH, the vertical point of the heavens at any place, that is, the point right above a spectator's head and from which a line drawn perpendicular to the plane of the horizon would, if produced, pass through the earth's centre, supposing the earth a perfect sphere. Each point on the surface of the earth has, therefore, its corresponding zenith. The zenith distance of a heavenly body is the arc intercepted between the body and the zenith, being the same as the coaltitude of the body.

ZENITH SECTOR, an astronomical instrument consisting of a telescope swinging upon pivots and having attached to it an arc graduated into degrees and minutes. It is used for the same purpose as the mural circle, namely, to ascertain the zenith distance of the several stars.

ZENITH TELESCOPE, an instrument used in field astronomy for the determination of latitudes, by the measurement of the difference of meridian-zenith distance of two

A Zenith Telescope

stars, one culminating north of the zenith, and the other at so nearly the same distance south that that difference can be measured by a fine micrometer in the field of the telescope when

the latter is revolved 180° round a vertical axis between the two culminations.

The determination of latitude with this instrument is frequently referred to as the 'American method,' because first practically employed by Captain Talcott of the United States Engineers in 1845. It is also sometimes called the 'Talcott method.' Prior to this time accurate latitudes were usually determined by the employment of the transit instrument mounted in the Prime Vertical, but this mode has been practically superseded by the present method, which is one of extreme accuracy and simplicity. It is employed for the determination of latitudes in the United States Coast and Geodetic Survey, in the larger fixed observatories, and, in fact, wherever accurate latitudes are desired. Its only drawback consists in the fact that it requires a special instrument, designed for the determination of latitudes alone, and not available for other kinds of astronomical observation.

ZENITH TUBE, an instrument designed for very accurate determinations of latitude by observing stars which transit the meridian close to the observer's zenith, or (when the latitude is known), for determining the declinations of such stars. It consists of a rigid, immovable telescope tube so mounted as to point always to the zenith; the plane of the telescope lens is thus horizontal. Within the tube, at a distance below the lens of slightly less than one-half of the focal length, there is a basin of mercury; the rays from a zenith star after passing through the objective are reflected from the mercury surface and finally come to a focus and form the image a short distance above the lens, a hole being drilled through the centre of this to allow of their passage. The micrometer wires are adjusted above the lens in this focal plane, both they and the image being reflected horizontally from a prism placed at this point into the eye-pieces, of which there are two on the sides of the main tube, one to the east and one to the west of it.

The great advantage possessed by the instrument consists in the fact that the observer's horizon (and, therefore, his zenith) is determined wholly by the surface of the mercury; the more usual level tubes, which always present irregular and annoying anomalies when employed for work of the highest accuracy, are wholly dispensed with. Only stars which enter the fixed field of the telescope, and hence pass within a few minutes of the zenith, can, however, be observed with it.

A very large zenith tube (aperture eight inches), was installed in the Flower Observatory of the University of Pennsylvania at Philadelphia in the year 1904, for the purpose of finding whether certain sudden changes of the local latitude, amounting in some cases to several feet, had a real existence, or whether they arose from undetected changes in the zenith telescope (q.v.), with which the latitudes had previously been determined. The new instrument agreed with the other in indicating occasional sudden changes in latitude, but their cause has not yet been discovered.

ZENJUN, *zĕn-jŭn'*, or **ZINJAN,** Persia, town and capital of the province of Khamseh, 190 miles northwest of Teheran, on the highway to Tabriz. It has postal and telegraph service and is important commercially to the surrounding district. Its elevation is 5,180 feet. It has manufactures of carpets, woolen cloths and arms. Pop 24,000.

ZENKER, Friedrich Albert VON, German physician: b. Dresden, 13 March 1825; d. Reppentin, Mecklenburg, 13 June 1898. He was educated at the universities of Leipzig and Heidelberg. From 1851 he was connected with the city hospital of Dresden and in 1855–62 he was also professor of pathological anatomy and general pathology at the Surgico-Medical Academy at Dresden. He was appointed professor of pathological anatomy and pharmacology at Erlangen in 1862, and in 1865 he became joint editor of the *Deutschen Archiv für klinische Medizin.* He is famous for his discovery of trichinæ in 1860, concerning which he published 'Ueber die Trichenenkrankheit des Menschen' (in Virchows' 'Archiv,' Vol. XVIII, 1860).

ZENKOJI, *zĕn-kō'jē*, Japan. See NAGANO.

ZENO, *zē'nō*, Emperor of the East (Byzantine empire) from 474 to 491 A.D. An Isaurian by birth and named Trascalisseus he changed his name to Zeno upon his marriage to the daughter of Leo I. He commanded the imperial guards and armies, and was elevated to the consulship in 469; procured the assassination of Aspar, the minister of Leo, in 471, and usurped the crown on the death of Leo in 474. He was driven out of his capital by Basilicus, who was proclaimed emperor in 475, but regained Constantinople in 477 by buying over Harmatius, the nephew and general of Basilicus, who was deposed and died shortly afterward. In 478 a Gothic invasion was bought off; in 479 a revolt in Constantinople was put down by corrupting the troops engaged; a second Gothic invasion was bought off, and a third was repelled by purchasing the aid of an opposing party among the Goths, one of whose chieftains, afterward Theodoric the Great, was made consul in 484. Having quarreled with Theodoric, Zeno in 487, anxious to save himself and his capital, proposed to him to invade Italy, and expel Odoacer and the Heruli. Among the more important events of his reign was the publication of the so-called 'Henoticon' (482), or 'Decree of Union,' intended to adjust the controversy between the Monophysites (q.v.) and the Orthodox Church.

ZENO, Apostolo, Italian dramatist and literary historian: b. Venice, 11 Dec. 1668; d. there, 11 Nov. 1750. He was a founder (1710) of the critical periodical *Giornale de' Letterati d'Italia,* in 1718–29 was at Vienna as court-poet, and made his reputation in Italian literature by libretti for the musical drama, which in his work attained real literary rank. For many years he was the chief dramatic poet of Italy. He was also a scholar, antiquary and well-known numismatist. His collected dramas appeared in 1744. Among his further writings is the 'Dissertazioni Istorico-Critiche e Letterarie' (1752–53). Consult the 'Life' by Negri (1816); Fehr, M., 'Apostolo Zeno und seine Reform des Operntextes' (1912).

ZENO, Nicolò and **Antonio,** Venetian navigators of the late 14th and early 15th centuries. Antonio about 1390 fitted a ship with which he sailed northward on the Atlantic. He was

wrecked on one of the Faroe islands. Here he would have been killed by the Scandinavian natives had he not been opportunely rescued by Earl Sinclair, whom Haakon VI of Norway had invested with the Orkneys and Caithness. He was made commander of the earl's small fleet, and in 1393 or 1394 sailed with three ships to Greenland, where he spent some time. He died in the Faroes about 1395. Antonio went out to the Faroes in 1391, and was in Sinclair's service for 14 years, dying at Venice in 1406. After Nicolò's death he was commander of the fleet; and on one occasion, to verify fishermen's reports of land some 1,000 miles westward, he undertook a voyage of discovery in the Atlantic. He described his adventures in a letter, and on this letter and some others and a sailing-chart, probably made by Antonio, is based a work containing matter of some interest in connection with pre-Columbian discovery in the New World. The letters were worked into a narrative, and, with a copy of the map, appeared in book-form in 1558. The narrative says that a fisherman, returning to the Faroes after a 26 years' absence, told of a land called Estotiland, where there was much gold and forest. The people built small boats and traded with Greenland. The description of Estotiland is vague, and contains little to suggest North America. But a voyage was undertaken from Estotiland to a region southward, called Drogio. There, said the fishermen, the people were cannibals. "They have no kind of metal. They live by hunting, and carry lances of wood, sharpened at the point." Farther south, "they have cities and temples," as well as "some knowledge and use of gold and silver." The honesty of the Zeno narrative has been sufficiently well established; but whether or not the fisherman had the experiences he narrated in Drogio, and whether that may be identified with North America, are questions that have been much debated. The map, drawn from hearsay, and necessarily of the vaguest character, was accepted as authentic and caused trouble for mariners and geographers for more than a century. Consult Major, 'The Voyages of Nicolò and Antonio Zeno' (Hakluyt Society, 1873), with a translation of the narrative and a copy of the map; and Fiske, 'The Discovery of America' (Vol. I, 1892).

ZENO (zē'nō) (Gk. Ζήνων) **OF CITIUM**, ancient Greek philosopher: b. Citium, island of Cyprus. He flourished in the late 4th and early 3d century B.C., and was the founder of the Stoic school of philosophy (see STOICISM). The circumstances of his life are not well known. Tradition says that after suffering shipwreck near the Peiræus, and according to one account losing his all, while by another his wealth amounted to 1,000 talents, he settled at Athens. There he early made himself remarked for the virtues of moderation and contentment, and during his long life he so acquired the esteem of the citizens that they voted him a crown of gold and a public burial in the Ceramicus. He is said to have declined the citizenship of Athens from fidelity to his native country. He first resorted to the teaching of the Cynic Crater, and by this school his own views, especially in the earlier period of his career, were much influenced. It may seem surprising that Zeno, who rejected both the contempt for established usages and for general knowledge which distinguished the Cynics, should have attached himself to that school, but the central point of every true system of philosophy is its ethics, and he was attracted to the Cynics by their doctrines of moral obligation, which he made the foundation of his own system. Contrary to the advice of Crater he afterward studied under Stilpo the Megarian. Among his subsequent advisers or teachers are enumerated the Megarians, Cronus and Philon, and the Academics, Xenocrates and Polemon. Of the last two he is said to have been a pupil. He maintained a friendship with Antigonus Gonatas, king of Macedon, of whom his disciples Persæus and Philonides were companions. About 310 B.C. he opened his school in the Ποικίλη Στοά (*Stoa*), or "Painted Porch." This place, which was adorned with paintings by Polygnotus, had formerly been the resort of a school of poets, who were from this circumstance called Stoics, and the name was now transferred from them to the disciples of Zeno, who at first had been called Zenonians. All the works of Zeno are lost. They were numerous, and include treatises 'On the State' (early and of cynical tendencies); 'On the Ethics of Crater'; 'On Life According to Nature'; 'On Impulse'; 'On the Nature of Man'; 'On the Affections'; 'On the Becoming' (or Fitting); 'On Law,' and 'On Grecian Education'; various treaties on physics, logic and poetry, and a work on the Pythagorean doctrine. Concerning the doctrines of Zeno, which employed very largely the ethics of the Cynic school, as well as the physics of Heraclitus and Pythagoras, see STOICISM; and consult also Zeller, 'Stoics, Epicureans, and Skeptics' (1870); Ueberweg, 'History of Philosophy' (Eng. trans., 1887); and Ritter and Preller 'Historia Philosophiæ Græcæ' (8th ed., 1898).

ZENO OF ELEA, ancient Greek philosopher: b. Ele (Velia), Lucania, southern Italy, about 488 B.C. He was the favorite disciple of Parmenides, whose opinions he defended and whose ethico-political schemes he shared. He appears to have lived for a considerable time in Athens, where he taught for remunerations, and had distinguished pupils as Pericles and Callias. He is said, on unsatisfactory evidence, to have engaged in an enterprise on behalf of his native land against the tyrant Nearchus. Whether he perished in this attempt or survived is not known. None of his writings are extant, but his opinions are referred to by Aristotle, who attempted to confute some of them, and who had distinguished him as the inventor of dialectic. As a defender of the Eleatic doctrine of the unity of the existent, he was the first to lay down the problems of skepticism in regard to the real existence of the phenomenal world, and has thus exercised an important influence on philosophy. He is said to have directed four arguments against the reality of motion. These all are very similar to one another; the two most famous are those of the flying arrow and of Achilles and the tortoise. The first finds a contradiction in the properties of the arrow, which cannot be where it is not, but is at rest if it remain where it is. That is, al-

though a body in motion is in motion throughout its course, if any instant of the existence of the body be considered in itself, there is no distinguishable property of the body which can be called motion. Bergson considers that the paradox, which was stated by Zeno in order to prove the specious character of motion and change, is insoluble on any view which analyzes motion into a series of states. An answer to the paradox which is more in favor among scientists follows outlines that had already been indicated by Aristotle, and depends upon the fact that the velocity or measure of motion of a body is a limit — the limit of the ratio of the distance traversed by a body, divided by the time which it takes the body to traverse the distance, as this time grows smaller and smaller. The distinction between a property of a body at an instant, and the limit of a property of a body in the neighborhood of that instant, is all-essential for the explanation of the paradox. This distinction was only rendered clear in the last century by the development of the theories of assemblages and of the functions of a real variable, which made clear the nature of continua and of continuous functions. It will be seen, then, how incorrect is the often-repeated statement that the paradoxes of Zeno were dialectical puerilities which were completely refuted by Aristotle.

The other famous paradox of Zeno is that of Achilles and the tortoise. Achilles, the swiftest of mortals, can never catch up with the tortoise, because when he reaches the tortoise's former position, the animal is no longer there, so that he has to traverse an infinite number of distances to overtake it. This argument is completely dependent on a clear distinction between the measure of an interval and the number of points it contains — a distinction whose true import has only been understood within the past 50 years. Zeno, in his arguments against motion, exhibits a truer appreciation of the nature of this process than is evinced by many moderns in their support of it.

In another argument, designed to establish the fallacious nature of sense-perception, Zeno shows his knowledge of the existence of sensory limina (see WEBER'S LAW). He points out the difficulty of understanding how, if the fall of one grain of wheat makes no audible noise, the fall of a bushel can be heard. See TIME; SPACE; ASSEMBLAGES, GENERAL THEORY OF; REAL VARIABLE, THEORY OF FUNCTIONS OF THE.

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ZENO OF SIDON, Epicurean philosopher: b. about 150 B.C.; d. about 80 B.C. He was a contemporary and instructor of Cicero, who refers to him in 'De Natura Deorum' (i, 34), as an accurate and highly cultivated thinker, but one who was scornful of other philosophers. His works are not in existence, but a treatise by Posidonius gives a summary of his beliefs and teachings.

ZENOBIA, zē-nō'bi-ą, queen of Palmyra (q.v.). Her native name was Septimia Bathzabbai, and she was instructed in the sciences by the celebrated Longinus, and made such progress that besides her native tongue she spoke the Latin, Greek, Coptic and Syrian languages. She also patronized learned men, and herself formed an epitome of Egyptian history. She was married to Odenathus, king of Palmyra, accompanied him both in the war and the chase, and the success of his military expedition against the Persians is, in a great degree, attributed to her prudence and courage. Gallienus, in return for services which tended to preserve the East to the Romans after the capture of Valerian by Sapor, king of Persia, acknowledged Odenathus as emperor, and on his death, 267 A.D., Zenobia assumed the sovereignty, under the title of Queen of the East. She preserved the provinces which had been ruled by Odenathus, and was preparing to make other conquests, when the succession of Aurelian to the purple led to a remarkable change of fortune. That martial prince, disgusted at the usurpation of the richest provinces of the East by a female, determined to make war upon her: and having gained two battles, Antioch and Emesa, beseiged her in Palmyra, where she defended herself with great bravery. At length, finding that the city would be obliged to surrender, she quitted it privately; but the emperor, having notice of her escape, caused her to be pursued with such diligence that she was overtaken just as she got into a boat to cross the Euphrates, in 272. Aurelian spared her life, but made her serve to grace his triumph. The Roman soldiers demanded her life, and according to Zosimus she purchased her safety by sacrificing her ministers, among whom was the distinguished scholar, Longinus. She was allowed to pass the remainder of her life as a Roman matron, and her daughters were married by Aurelian into families of distinction. Her only surviving son retired into Armenia, where the emperor bestowed on him a small principality. Consult Gibbon, 'Decline and Fall' (ed. Bury, 1896-1900); 'Life of Aurelian' by Vopiscus in 'Augustæ Historiæ Scriptores' (Eng. trans., Bernard 1740); Ware, 'Zenobia, or The Fall of Palmyra' (1837).

ZENOBIA, or THE FALL OF PALMYRA, a noted historical novel, by William Ware, first issued in 1837 in the *Knickerbocker Magazine,* and then entitled 'Letters from Palmyra.' It was shortly afterward published in book form, and later editions were issued from time to time for more than 50 years.

ZENOS, zē'nōs, Andrew Constantinides, American educator: b. of Greek parentage, Constantinople, Turkey, 13 Aug. 1855. He was graduated at Robert College, Constantinople, in 1872, studied theology at Princeton Seminary and was pastor of a Presbyterian church in Brandt, Pa., 1881-83. From 1883 to 1888 he was professor of Greek in Lake Forest University and of New Testament exegesis at Hartford Theological Seminary 1888-91. In 1891 he was made professor of church history in McCormick Theological Seminary in Chicago, and in 1894 was transferred to the chair of biblical theology in that institution, a position he still (1919) holds. He wrote 'Elements of Higher Criticism'; 'Compendium of Church History' (1896); 'The Teachings of Jesus Concerning Christian Conduct' (1905); 'The Son of Man'

(1914), etc.; edited Xenophon's 'Anabasis' (with F. W. Kelsey (1888), and was co-editor of 'The Standard Bible Dictionary' (1909).

ZENTA, zĕn'tŏ, Hungary, a town in the county of Bács-Bodrog, on the Theiss, 120 miles southeast of Budapest. Here, 11 Sept. 1697, the Germans under Prince Eugene of Savoy, defeated the Turks, a victory which led to the Peace of Carlowitz, ratified January 1699. Pop. about 30,000.

ZEOLITE, a name given to a group of hydrated silicate minerals commonly found in cavities in igneous rocks, from which they are derived through secondary alteration. They include thompsonite, natrolite, scolecite, analcite, chabazite, gmelinite, phillipsite, harmotome, stillite and heulandite. The name is derived from the boiling reaction before the blowpipe.

ZEPHANIAH, zĕf-ą-nī'ą, the ninth in order of the Scriptural writers known as the minor prophets. His pedigree is traced back for four generations. He is the son of Cushi, the son of Gedaliah, the son of Amariah, the son of Hezekiah and he is supposed to have been of noble, if not of royal, ancestry. His brief but pregnant prophecy was delivered just after the time of the first appearance of Jeremiah (626 B.C.)—that is, in the first half of the reign of Josiah. The next preceding prophet was Micah, who died in the early part of the reign of Manasseh. But the condition of the whole of western Asia, including Palestine, portended a speedy upheaval. Above all, Nineveh was beginning its memorable decline after the death of its king. Assur-banipal (668–626 B.C.). Morally and religiously the Jewish nation had improved but little since the degeneracy that had followed the death of Hezekiah, and Josiah's reform (621 B.C.) had not yet begun, if we may judge the invectives of the prophet against idolatrous practices. Zephaniah was apparently a descendant of King Hezekiah.

The Prophet's Message.—Zephaniah spoke and wrote primarily for the correction and warning of Judah and Jerusalem, though he draws illustrations from the sins and fates of other peoples. The culmination of these is found in the iniquities, the pride and the speedy fall of Nineveh. His prophecy extends to three chapters in the Bible. A division into four parts is as follows:

The threatening: ch. i (1), the whole world—that is, the Semitic world—is to undergo exemplary punishment, particularly Jerusalem and its apostates from Jehovah (ver. 1–6). (2) The classes of people who are to be thus visited—the royal house, the nobles, the wealthy traders, the careless and defiant generally—are characterized, and their chastisement set forth in language largely figurative (ver. 7–18).

The lessons from the nations: ch. ii. God's own people are warned to repent in time (ver. 1–3), and so avoid the doom that is about to fall upon the Philistines (ver. 4–7), Moab (ver. 8–11), Egypt, under the name of Ethiopia (ver. 12), and finally Assyria and Nineveh (ver. 13–15).

The remonstrance: ch. iii, 1–7. Rebellious and obstinate Jerusalem is urged to repent by the righteous and reasonable God, in view of coming woes; for the lesson of the fate of other nations has so far been unheeded.

The promised redemption: ch. iii, 8–20. (1) The faithful remnant is bidden to wait and trust. It shall survive the ruin of the nations, be joined by exiled brethren from far and near, and rest in quiet content (ver. 8–13). (2) Joyous thanksgiving is now in place, for Jehovah is in the midst of Jerusalem, to comfort and bless his people. Their reproach is taken away; dispersion and captivity are at an end.

ZEPHANIAH, Book of. The title of the book of Zephaniah says that the prophetic message was given in the days of Josiah, king of Judah, 639–608 B.C. Since that time is appropriate for the book, the title is usually considered to rest upon an historical basis, although other suitable times for these utterances might be found. In the title Zephaniah is said to have been the great-great-grandson of Hezekiah, by whom the king of that name is doubtless meant. This also is generally accepted, since the book contains nothing out of harmony with the royal descent.

It is evident that the message of Zephaniah must have preceded the introduction of the Deuteronomic law in 621. This is because the conditions here reflected are such as doubtless belonged to the early part of the reign of Josiah, but were somewhat changed, perhaps only temporarily, by the Deuteronomic reform. The characteristic features are religious syncretism, astral worship, imitation of foreign customs, and scepticism, i, 4–6, 8, 9, 12. Since the book shows no clear influence of Jeremiah it is probably to be dated not later than the beginning of his work. That indicates a date of about 627 B.C.

The background of the book is some great invasion affecting many lands. At the time mentioned that must have been the Scythian invasion, alluded to in Jeremiah i, as a danger from the north. The invasion cannot have come from Egypt or Assyria, since both are mentioned as affected by it, ii, 12. This Scythian invasion, it is known, affected Assyria and extended to the borders of Egypt, overrunning also several of the intermediate countries. It lasted for a considerable number of years, and, while its limits cannot be determined with entire certainty, the year mentioned, 627, was quite evidently near the beginning of its course.

The theme of the book is the coming of the day of Yahweh. This is probably not to be regarded as identified with the Scythian invasion, but the latter is an introductory movement indicating that it is at hand. The day of Yahweh is first mentioned by Amos, and then as a familiar idea. As here presented the destruction of that day is to engulf Judah, Philistia, Moab, Ammon, Ethiopia (Egypt) and Assyria; but the mention of Moab and Ammon is often considered a later addition. That day, while regularly a day of world-judgment in some real sense, is here presented in unusually vivid terms as a day of universal judgment and destruction. The judgment upon Judah has an ethical basis, a point which does not appear in the condemnation of the other nations.

Zephaniah, like Amos whom he resembles, is distinctly a prophet of judgment. Most of the book gives little suggestion of mercy. At the end, however, are several verses of a different tenor which, as in the parallel case in Amos, are to be regarded as a later addition.

This applies most clearly to iii, 14–20. Here is a message of restoration of the people now scattered among the nations. This belongs to the exile or, more probably, after the exile. iii, 9–10 is probably also a later addition because its attitude toward the nations is out of harmony with most of the book. Other passages sometimes considered to be later are less certainly so; most prominent among these is ii, 8–11, which has suggestions of the exile.

While Zephaniah adds nothing of fundamental importance to the messages of the line of prophets who have preceded him, yet his utterance is characterized by a zeal for righteousness and a vigor of presentation not unworthy of that goodly fellowship. Historically, his testimony to the conditions in the time shortly before the reform of Josiah is of much value.

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ZEPHYR, a soft, cool, agreeable wind; in Greece the west, or rather west-southwest wind, typified in Greek mythology by the god of the west wind Zephyrus (q.v.). The Greek name, according to the etymology, signifies life-bringing, because at the time when this wind begins to blow, the plants are restored to life by the balmy spring air.

ZEPHYRANTHES, a genus of *Liliaceæ*, indigenous to the warmer regions of America, and most commonly represented by the atamasco lily. The species are bulbous, and are not hardy in the Northern States, but make charming summer-blooming window and greenhouse plants, resting in the winter. The foliage is linear, springing from the bulb, and a scape, appearing at the same time, is crowned by a regular, three-parted corolla which is nearly, or quite, erect, from one to three inches across, and red, yellow or white. *Z. candida* is one of the white-flowered species, and is also one of the hardiest and thriftiest. It is a lovely, crocus-like plant, with pure-white blossoms, opening out flat in the sunshine, and evergreen foliage.

ZEPHYRUS, zĕf'ĭ-rŭs, in Greek mythology, the god of the west-wind, a son of Æolus, or of Astræus and of Aurora. He was married to Chloris, goddess of fruits and flowers, their son being Carpus, god of fruit. By the harpy Podarge he was the sire of the swift horses of Achilles, Xanthos and Balios. His love being rejected by Hyacinthus, he was the cause of his death by blowing Apollo's quoit against his head. Some make him the husband of one of the Hours. Flowers and fruits are under his protection. He is represented as a gentle beautiful youth, naked, with a wreath on his head or flowers in the fold of his mantle. According to Homer he was brother to Boreas, with whom he lived in a palace in Thrace. The Romans identified him as Favonius, and his wife, Chloris, as Flora.

ZEPPELIN, tsĕp'pĕ-lin, **Ferdinand,** COUNT VON, German airship builder: b. Constance, Baden, 8 July 1838; d. Charlottenburg, Prussia, 8 March 1917. His father was Count Friedrich von Zeppelin, a Württemberg court official. After studies at the Stuttgart Polytechnicum, the Ludwigsburg Military Academy and the University of Tübingen, he entered on a military career and as a lieutenant was one of the German military observers in 1863 attached to the Army of the Potomac during the Civil War in the United States. His first ascent in a balloon made at Saint Paul, Minn., during this visit, is said to have been the incentive of his later experiments in aeronautics. He took part in the Seven Weeks' War of 1866, fighting for Wurttemberg against Prussia, and was an officer of cavalry in the Franco-German War 1871–72. He rose to the rank of lieutenant-general in the German army and in 1891 at the age of 53 retired and devoted his time and wealth to experiments in connection with dirigible balloons. While increasing proofs of success encouraged him to continue his efforts, a record of failures which reduced him to poverty marked his experiments for several years. Imperial patronage and public subscriptions, however, enabled him at last to conquer all difficulties, and in 1908–09 dirigibles of the type constructed with his name were making successful journeys ranging from 350 to 1,000 miles. Thirteen Zeppelins, however, had been destroyed and numerous lives sacrificed during the experiments up to 1914. During the European War, Zeppelins were used mostly for raids over Belgium and England, and over 40 were reported as destroyed. Their failure as warships is said to have been a great disappointment to Count Zeppelin. (See AERONAUTICS; DIRIGIBLE). Consult Hearne, R. P., 'Zeppelins and Super-Zeppelins' (New York 1916).

ZERAFSHAN, zĕr-ăf-shăn', Asiatic Russia, a river rising in a valley at the junction of the Hissar and Turkestan Mountain chains, and after a westerly by north course of about 400 miles, passing the towns of Penjakent, Samarkand, Katakurgan, Kerminch and Bokhara, dispersing itself in the desert sands, between Karakul and the Oxus River. A railway line traverses the valley from Karakul to near Penjakent.

ZERAH, (Heb. *Zarach*), king of Ethiopia, known to the Egyptians as Azech Amen, who flourished in southern Egypt about 900 B.C. He conquered Egypt and invaded Palestine, where he was defeated by Asa, king of Judah. Zerah then abandoned not only Palestine, but also Egypt (2 Chron. xiv).

ZERBI, or DE ZARBIS, Gabriel, Italian physician and anatomist: b. Verona in the 15th century; d. there, 1505. He lectured for some time at Rome, and became professor of medicine at Padua in 1495. His chief work is 'Anatomy of the Human Body' ('Liber Anatomiæ Corporis humani'), published about 1490, a work remarkable for its keen insight and deductions confirmed by later discoveries in anatomy.

ZERBONI DI SPOSETTI, Joseph, German philosopher: b. Breslau, 1760; d. 1831. In 1796 he wrote to the governor of Silesia a letter in which he set forth the absurdity of granting to the nobility exalted privileges through

right of birth. Knowledge of the letter reaching Frederick William III, he was imprisoned for three years on a charge of high treason. When his case was brought to trial he was freed, with no political disability, and later received various official appointments.

ZERBST, tsĕrpst, Germany, a town in the duchy of Anhalt, on the Nuthe, a small tributary of the Elbe, 70 miles southwest of Berlin, and 27 miles southeast of Magdeburg, on the Dessau-Leipzig Railway. The chief buildings are the great Schloss in a fine park; the 15th century Nikolaikirche, and the stately 15th century Rathhaus on the market place where are the Roland column (1445) and the Butterjungter, a slender column bearing a female figure. The chief educational institution is the Francisceum, a gymnasium of high repute. The town has manufactures of noted bitter beer, of silks, plush, cloth, leather, machinery, musical instruments, etc. Zerbst was founded in 1007. From 1603 to 1793 it was the capital of a principality of the same name, which in 1797 was absorbed in Anhalt-Dessau. Pop. of commune about 19,210.

ZERFFI, George Gustavus, English author: b. Hungary, 1821; d. Chiswick, England, 28 Jan. 1892. He edited a newspaper at Budapest, and in 1848 served as a captain in the revolutionary army. He also acted for a time as Kossuth's private secretary. On the failure of the revolution in 1849 he went to England and was naturalized, and some years later was engaged as a lecturer in the department of art at South Kensington. Throughout his career Zerffi gave much attention to the subjects of decoration and history, and wrote many works treating these themes in a comprehensive manner. He asserted that history should be studied as a whole on philosophical principles. He planned a general work on these lines entitled 'Studies in the Science of General History,' of which two volumes were issued, dealing with ancient and mediæval history respectively. Among his other publications are 'A Manual of the Historical Development of Art, with Special Reference to Architecture, Sculpture, Painting and Ornament' (1876); an English version of Goethe's 'Faust' with critical and explanatory notes (1859); he also published a number of his lectures.

ZERIBA, or ZAREEBA, a temporary military enclosure, the sides of which are formed of prickly brush wood, sheltered by which a force may camp comparatively safe from sudden surprise. The term came into prominent use during the Anglo-Egyptian campaign of 1884. The protection is also used against wild animals.

ZERMATT, tsĕr-mät', or zĕr-mät' (formerly called **PRABORGNE**), Switzerland, a mountain village and tourist-resort in the canton of Valais, at the foot of the Matterhorn and near the head of the Visp Valley, 22½ miles by rail southwest of Visp. It stands 5,315 feet above sea-level, having to the south the great Théodule glacier, above which tower the Breithorn on the east, and beyond the Monte Rosa group, and on the west the rocky cone of the Matterhorn. An electric mountain railway connects with the Riffelberg and the summit of the Gornergrat (10,290 feet). The Théodule Pass or Matterjoch (10,899 feet) leads to Aosta in Italy. Its scenery compares in grandeur with that of Grundewald and Chamonix. In the village churchyard are the graves of many victims of mountaineering. Pop. about 750.

ZERO, *in mathematics*, the absence of magnitude; the remainder that is obtained when any quantity is subtracted from itself; nothing, considered as a quantity; that which separates real positive quantities from real negative quantities. Zero is denoted by the symbol 0 ("cipher"), and this symbol itself is often called "zero." In the theory of functions, any value of a variable which reduces a given function of that variable to zero is called a "zero" of the given function. In infinitesimal analysis, infinitesimal quantities are sometimes called zeros. This usage is incorrect, and it leads to confusion of thought. An "infinitesimal" has an actual magnitude, and although that magnitude is smaller than any quantity that can be definitely stated or assigned, the fact that it exists distinguishes the infinitesimal from zero, properly so-called.

In physical measurement, the "zero" of any scale is the starting point from which measurements on that scale are reckoned. In thermometry (q.v.) it is customary to distinguish three different kinds of zeros. These are, respectively, (1) the arbitrary zero, (2) the "natural" zero and (3) the "absolute" zero. The arbitrary zero on such a scale is a zero that is selected arbitrarily, as a convenient point of reference; the selection being governed by practical considerations of convenience, or by the facility with which the point can be experimentally determined. (See THERMOMETER). The "natural" zero is employed chiefly in connection with the gas thermometer. In a gas thermometer in which the temperature is indicated by the expansion of a given volume of gas at constant pressure, the "natural" zero is the temperature at which the volume of the gas would just vanish, if the contraction of the gas were to follow, at very low temperatures, the law of variation with temperature that prevails between the freezing and boiling points of water. Similarly, in a gas thermometer in which temperature is measured by the change in pressure of a mass of gas that is confined at constant volume, the "natural" zero is the temperature at which the pressure of the gas would just vanish, if the law of variation of pressure were the same, at very low temperatures, as it is between the freezing and boiling points of water. The "natural" zeros of the various gas thermometers that are in actual use are not identical, but their positions differ only by a few degrees, at the most.

The "absolute" zero of temperature is the temperature that a body would have, if it were absolutely deprived of heat; and this "absolute" zero is identically the same for all substances. It happens that the "absolute" zero has nearly the same position on the thermometer scale as the "natural" zeros of the various gas thermometers that are in use, and this fact has led to a great deal of confusion in popular and semi-scientific writings upon the subject of temperature, the "natural" and "absolute" zeros being

very commonly confounded with one another. The "absolute" zero is slightly lower than the "natural" zero of any gas thermometer that we know of, with the possible exception of the "natural" zero of the hydrogen thermometer. There is some reason for believing that the "natural" zero of the normal hydrogen thermometer (whether at constant volume or at constant pressure) is a few hundredths of a centigrade degree lower than the true "absolute" zero. If further research bears out this opinion, then it is plain that the "natural" zero of the hydrogen thermometer can never be attained; for the "absolute" zero, being the temperature corresponding to absolute cold, is the lowest temperature that can possibly have a real existence. On the absolute centigrade scale, the temperature of the "absolute" zero is approximately 273.10° below the freezing point of water. This estimate is probably in error by a few hundredths of a degree. There is no theoretical reason why the position of the "absolute" zero cannot be determined to the thousandth of a degree; but the experimental data required for such a determination are not yet available. See THERMODYNAMICS.

ZERRAHN, Carl, American musical conductor: b. Malchow, Mecklenburg, 28 July 1826; d. Milton, Mass., 29 Dec. 1909. In 1848 he came to America as flute-player with the Germanica Orchestra, and six years later became director of the Handel and Haydn Society of Boston, a position he held for 42 years. He was conductor of the Harvard Symphony concerts 1861–82, and for several years was a successful director of famous musical festivals throughout New England, among them being those at Worcester, Mass., which he conducted in 1866–97. He retired in 1898.

ZERUBBABEL, zĕ-rūb'ą-bĕl, leader of the first band of Israelitish exiles returning from Babylon. He name in the Captivity was Sheshbazzar. He was the recognized prince of Judah, son of Shealtiel, governor of Judah (Hag. i, 12, 14), and on arrival at Jerusalem, with Jeshua, the high-priest, directed the renewal of public daily worship and of festival days, and in the second month of the second year of the return, the reconstruction of the Temple. This last work was stopped by their foes and revived only after 16 years, when it was again undertaken and finally completed by Zerubbabel and Jeshua.

ZETA, zē'tą, (1) the Greek equivalent of the English letter Z, and sixth in the Greek alphabet. (2) a small closet or chamber; applied by some authorities to the room over the porch of a Christian church, where were kept the documents of the church and also containing quarters of the sexton.

ZETLAND ISLANDS. See SHETLAND.

ZEUGLODON, zū'glō-dŏn, a gigantic fossil cetacean mammal, found in the Eocene and Miocene strata of the southern United States and Europe, so named by Owen from the yoke-like character displayed by a section of the molar teeth. Its remains were first discovered in 1834 in the Tertiary of Louisiana, and were supposed to belong to some reptile, to which Dr. Harlan gave the name of *Basilosaurus*, but Owen showed that it was a mammal, and belonged among cetaceans. A few years later a German collector named Koch collected great quantities of the bones and stringing them together in some semblance of a natural skeleton, constructed a "sea-serpent," mostly neck and tail, no less than 114 feet long, which was exhibited widely in America and Europe, and required the exertions of eminent men (for example, Wyman, 'Proc. Boston Soc. Nat. Hist.,' November 1845) to expose as a humbug. The form was probably cetacean, though slender, elongated and more snake-like, with small anterior limbs in the shape of paddles, and no hind limbs; the length about 70 feet; the skin was supplied with an armor consisting of small irregular bony plates more or less fused together. The skull in some specimens was nearly a yard in length. It is well constructed, the blow-hole in the middle of the face, and the brain-cavity. The teeth are limited in number and disposed in three series as incisors, canines and molars; the molars are double-rooted, and have serrated crowns. Much discussion has occurred as to the affinities of this great sea-beast, whose characters are so generalized, and period of existence so early that it is now agreed to be a representative of the most primitive *Cetacea*, and is set apart as a family, *Zeuglodontidæ* constituting a primitive order *Archæocæti*. Consult Woodward, 'Vertebrate Palæontology' (New York 1898); Zittel-Eastman, 'Text-Book of Palæonotology' (Part III); Lucas, F. A., 'Animals in the Past' (1901), and 'The Pelvic Girdle of the Zeuglodon' (1901).

ZEUGMA, zūg'mą, the connection of one word with two words or with two clauses, to both of which it does not equally apply; so that, for one of them, another word (to be gathered from the sense of the passage) must be mentally supplied. Zeugma is, therefore, a species of ellipsis; both abbreviate discourse. Where the word to be supplied is a form of another in the sentence, as "I love you, and you [love] me," the construction is elliptical; where the sense requires a different word, as "The sun shall not smite thee by day, nor the moon [injure thee] by night" (Ps. cxxi, 6) (Prayer Book), it is zeugma.

ZEUNERITE, a hydrous copper-uranium arsenate, $Cu(UO_2)_2As_2O_8.8H_2O$. Minute yellowish-green crystals with barite in ores of the Tintic district, Utah. A possible source of uranium.

ZEUS, zūs (Greek Ζεύς), in Greek mythology, the chief of the gods. He was the son of Cronus and Rhæa. According to the myth Cronus was in the habit of swallowing his children immediately after their birth. When Zeus was about to be born Rhæa consulted Uranus and Gæa as to how he might be saved, and they sent her to Crete (the Trojan Ida and other places are mentioned in other accounts) to be delivered. She concealed Zeus in a cave in Mount Ida, and gave Cronus a stone wrapped up in a cloth to swallow. The infant Zeus was tended by the nymphs Ida and Adrastea. He was supplied with milk by the goat Amalthea, and the bees gathered honey for him. When he had reached manhood, by the aid of Gæa or Metis he persuaded his father to restore to the light the children he had swallowed. Zeus now united with his brothers to dethrone his father. This led to a war with the Titans, a struggle

not terminated until Zeus delivered the Cyclopes, sons of Uranus and Gæa, who had been bound by Cronus, and who in return provided him with thunder and lightning, and also liberated the hundred-handed beings Briareus, Cottus and Gyes, who likewise lent him their aid. Having vanquished the Titans, the other children of Uranus and Gæa, he shut them up in Tartarus. Tartarus and Gæa now begot another monster, Typhœus, who engaged in a fearful struggle with Zeus, but was finally vanquished by a thunderbolt. Zeus now obtained the dominion of the world, which he divided by lot with his brothers Poseidon (Neptune), who obtained the sea, and Hades (Pluto), who received the lower world. Zeus retained for himself the heavens and the upper regions, while the earth was held as common property. Another dreadful war was now waged against the Olympian gods by the giants sprung from the blood of Uranus. In this struggle the gods were assisted by Athene, Apollo, Heracles and other children of Zeus, and the giants were completely vanquished. Zeus had three sisters and three brothers, Hestia (Vesta), Demeter (Ceres) and Hera (Juno). He first married Metis, a daughter of Oceanus and Tethys; but as Fate had prophesied that she should bear a son who should rule the world, Zeus swallowed her when she was with child, and Athene subsequently sprang from his head. As his second wife he took, for a time, Themis, daughter of Uranus and Gæa, but his final and best-beloved consort was his sister Hera, by whom he had Hebe, Ares and Hephæstus. Zeus was regarded at the height of the organization of the Roman pantheon, as the founder of law, order and authority, the avenger of wrongs, the punisher of crime, the rewarder of good actions, the source of prophetic power, the author of all good things and the omnipotent, all-wise and benevolent ruler of the universe. He was especially looked upon as the controller of all the phenomena of the heavens, and was constantly spoken of as the "Cloud-gatherer" or the "Thunderer." Notwithstanding his general character of wisdom and benevolence, his conduct was anything but immaculate. The incongruity struck some of the ancients themselves, and led to protest against such stories being believed. There appear to have been various local gods of the same name, with various attributes and legendary histories, who were finally merged in the national Hellenic Zeus. Traces of the original traditions, however, remained in the local rites of particular places. An Arcadian and a Cretan Zeus are particularly distinguished. The former had a temple at Mount Lycæus, so sacred that if any one entered it he died within 12 months, while intentional trespassers were stoned to death. In Crete there were many places sacred to Zeus, who had passed his early life there, particularly Mount Ida and the district around it. Zeus, according to tradition, also landed on the island at Gortyn in the shape of a bull, when he carried off Europa, and was worshipped there by the surname of Hecatombæus. The national god was worshipped by sacrifices of bulls, cows and goats. Two of the principal localities where his worship was carried on in Greece were Athens and Olympia. At the latter place the Olympic games, the most splendid festival in Greece, were held in his honor. (See OLYMPIC GAMES). Here there was a magnificent temple and a gold and ivory statue of the god, the work of Phidias, and reckoned one of the seven wonders of the world. In representations of Zeus his attributes are the eagle, the sceptre and the thunderbolt. See ROMAN RELIGION. Consult Preller-Robert, 'Griechische Mythologie' (1887).

ZEUSS, tsois, **Johann Kaspar,** German philologist and historical scholar: b. Vogtendorf, near Kronach, in Upper Franconia, 22 July 1806; d. there, 10 Nov. 1856. He was educated in Munich, and became professor of history in the lycée at Bamberg, Upper Franconia. He wrote several valuable books—'Die Deutschen und die Nachbarstämme' (1837); 'Die Herkunft der Bayern von den Markomannen' (1839); 'Traditiones Possessionesque Wirzenburgenses' (1842); 'Die Freie Reichstadt Speier vor ihrer Zerstörung' (1843). But his greatest work was 'Grammatica Celtica' (1853; 2d ed., by Ebel, 1868–71), a pattern of scholarship and thorough method, in which he really founded the science of Celtic philology. Consult Kuhn, E., 'Johann Kaspar Zeuss' (1906).

ZEUXIPPUS, zūk-sĭp'ŭs, one of the eight successors of Ænesidemus (q.v.) in the last school of Greek skeptics. Of him, as of all the others with the exception of Sextus Empiricus (q.v.), nothing further is known. Consult Zeller, E., 'Outlines of the History of Greek Philosophy' (trans. Alleyne and Abbott, 1886).

ZEUXIS, zūk'sĭs (Greek Ζεῦξις), ancient Greek painter. He was a native of Heraclea, but which town of that name was his birthplace is not certain. He was born about the middle of the 5th century before Christ, and flourished about the end of the 4th century B.C. He is said by some authorities to have studied under Demophilus of Himera, by others under Neseas of Thasos. He also studied at Ephesus, where he eventually settled, although he worked at times at Athens and other cities. Aristotle says that an elevated conception of character was wanting in his work, while Cicero praises him along with Polygnotus and Timanthes for *formæ et lineamenta.* He learned from Apollodorus the treatment of light and shade, which he greatly developed, and from Phidias to take Homer's descriptions of his heroes as ideal models and to paint them with limbs larger than the ordinary human proportion. One of his most famous works was a picture of Helen for the temple of Hera at Croton. The rivalry of Zeuxis and Parrhasius is represented in a well-known story about a contest in which Zeuxis painted grapes at which the birds pecked, and Parrhasius a curtain which Zeuxis wished to have raised in order to see the picture. Some of his later works he gave away as being valuable beyond any fixed price. As far as may be judged from extant accounts, he painted small works on panels in contrast to the large mural paintings of Polygnotus. It is, of course, now impossible to form a correct idea of his art, though more anecdotes are told of him than of any other painter of antiquity. These are to be found in Lucian, Cicero, and especially the 'Historia Naturalis' of Pliny. Among his other works were 'Zeus on His Throne Sur-

Byzantine fortress. Ancient Zela was a theocracy ruled by the priests of the temple of Anaitis. Here Mithridates won a victory over the Romans 67 B.C., and it was also the scene of Cæsar's victory over Pharnaces, 47 B.C., concerning which Cæsar wrote "*Veni, vidi, vici.*" Pop. 20,000.

ZILLER, tsĭl'lĕr, **Tuisken,** German educator: b. Wasungen, Saxe-Meiningen, 22 Dec. 1817; d. Leipzig, 20 April 1882. He was educated at Leipzig, where he was at first a lecturer in jurisprudence, but in 1854 became professor of philosophy and pedagogy. At his initiative the Verein für Wissenschaftliche Pädagogik was founded. Among his books are 'Einleitung in die Allgemeine Pädagogik' (1856; 2d ed., 1901) and 'Allgemeine Philosophische Ethik' (1880; 2d ed., 1886).

ZILLERTHAL, tsĭl'lĕr-tăl, Austria, a valley of the Tyrol in the eastern Alps, about 25 miles below Innsbruck, famous for its scenic beauties. It is traversed by the Ziller, which joins the Inn River at the mouth of the valley. It is much frequented by tourists, a railway line connecting with Mairhofen in the valley.

ZIMBABWE, zĕm-bäb'wā, or **ZIMBABYE** (Bantu for "here is a great kraal"), a name applied to numerous interesting South African ruins in Rhodesia and the Transvaal. They were discovered by Adam Benders in 1868. The best known and most important is the Great Zimbabwe, near the Sabi River, about 17 miles from Victoria in southern Rhodesia. There are two principal structures at Great Zimbabwe, one on the crest of a granite hill breaking down precipitously to the south, and the other on the level ground about a third of a mile to the south. The lower one is roughly circular or elliptical, enclosed by a wall of 30 or 40 feet high, 14 feet thick at the base, and from six to nine feet thick at the summit. The wall is composed of well-trimmed blocks of granite fitted together without mortar in regular courses and occasionally set angularly for ornamental purposes. An inner wall runs close to the outer for a considerable distance, forming a passage which leads to a sacred enclosure containing two conical solid towers, the larger of which is some 40 feet high. The rest of the enclosure is divided into irregular unroofed chambers. The building on the hill is very strongly built for defense and also contains a sacred enclosure. Emblems, believed by some to be phallic, many curious objects in soapstone, and undoubted remains of gold-working utensils have been found in the Zimbabwes. The nearest gold deposits and ancient gold workings are, however, some miles distant. Some theorists would locate here the Ophir of Solomon. It is also suggested that the lower building was a kind of town occupied by pre-Mohammedan Arabs who came here in search of gold, and that the ruin on the hill was a stronghold for defense. The signs of orientation reported by earlier visitors were disproved by scientific investigators who explored the ruins in 1905. The theories of Bent are now definitely discarded. Consult Randall-MacIver, D., 'Mediæval Rhodesia' (1906); for illustrations Bent, J. T., 'The Ruined Cities of Mashonaland' (1892); and Hall and Neal, 'The Ancient Ruins of Rhodesia' (1902).

ZIMMERMAN, Eugene ("Zim"), American caricaturist and illustrator: b. Basel, Switzerland, 25 May 1862. After a public school education in Paterson, N. J., and some time in various employments, he turned his attention to comic art, was on the staff of *Puck* illustrators in 1882-85, and in 1885 became connected with *Judge*. He also did illustrations for some of the works of J. W. Riley ("Bill Nye") and others. He conducted Zim's Correspondence School of Cartooning, Comic Art and Caricature. Author of 'This and That About Caricature' (1892-93).

ZIMMERMAN, Jeremiah, American clergyman, author, educator and numismatist: b. Snydersburg, Md., 26 April 1848. Graduated from Pennsylvania College, Gettysburg, in 1873, and the theological seminary there in 1876, he was pastor of the Lutheran Church at Valatie, N. Y., in 1877-78, and in 1879 organized at Syracuse, N. Y., the First English Lutheran Church, of which he was pastor until 1904. He then resigned to engage in foreign travel and literature, specializing on the Far East, archæology and history. He is also regarded as an authority on the historical branch of numismatics, and has been professor of numismatics at Syracuse University since 1912. Author of 'Spain and her People' (1902); 'The Religious Character of Ancient Coins'; 'The God Juggernaut and Hinduism in India' (1914), etc.

ZIMMERMANN, tsĭm'mĕr-măn, **Albert,** German painter: b. Zittau, Saxony, 20 Sept. 1809; d. Munich, 18 Oct. 1888. He studied in Dresden and Munich and was made professor in the Milan Academy in 1857 and at the Vienna Academy in 1859. His works display admirable characterizations of mountainous scenery and excellent light-effects, and are represented in the museums at Leipzig, Munich, Stuttgart, Hanover, Dresden, Frankfort and in the R. L. Stuart Collection (New York Public Library). Among them are 'Rocky Landscape with Centaurs and Leopards'; 'Chiem Lake in Storm'; 'The High Goll'; 'Sunset on Hintersee'; and 'Lake Como.'

ZIMMERMANN, Johann Georg, Ritter von, Swiss philosopher and writer: b. at Brugg, canton of Aargau (then in Bern), 8 Dec. 1728; d. Hanover, 7 Oct. 1795. He studied medicine under Haller at Göttingen, and in 1754 was appointed public physician to his native town. He employed his leisure in the publication of pieces in prose and verse, including the first sketch of his popular work 'Ueber die Einsamkeit' (On Solitude, 1756; completely rewritten 1784-85). This was followed by his essay 'Vom Nationalstolz' (On National Pride 1758). In 1763 he composed his work 'Von der Erfahrung in der Arzneikunst' (1764), which he followed up by several other professional treatises; in consequence of which he received an offer of the post of physician to the king of England for Hanover, which he accepted, and removed in 1768 to that capital. In 1786 he attended Frederick the Great in his last illness, which afforded little room for medical skill, but enabled him to publish an account of his conversations with that celebrated sovereign, 'Ueber Friedrich den Grossen und meine Unterredung mit ihm' (1788), and 'Fragmente uber Friedrich den Grossen' (1789), works of little value. His 'Solitude' was at one time very popular, and

was translated into almost every language of Europe. Consult the studies by Bodemann (1878) and Ischer (1893).

ZIMMERMANN, Wilhelm, German poet and historian: b. Stuttgart, 2 Jan. 1807; d. Mergentheim, Würtemberg, 22 Sept. 1878. After study at Tübingen, he was connected with various journals at Stuttgart, from 1847 to 1850 was professor of history and of German language and literature in the Polytechnic Institute there, but lost the post through his liberal attitude as a member of the German National Assembly (1848) and the Würtemberg Parliament. Subsequently he was pastor of Evangelical churches at Leonbronn, Schnaitheim and Owen. He is best known for his 'Gedichte' (1832; 2d ed., 1839; 3d ed., 1854), which reveal the influence of Schiller and Uhland, but are never merely imitative. Others of his publications are 'Befreiungskämfke der Deutschen gegen Napoleon' (1836; 3d ed., 1859); 'Geschichte des Grossen Bauernkriegs' (3 vols., 1841–43; 3d ed., 1891), etc.

ZIMMERN, Helen, English author: b. Hamburg, Germany, 25 March 1846. She was taken to England when an infant and was naturalized as a British subject upon coming of age. After a secondary education at Bayswater, she became a contributor to *Once a Week, Old Merry's Monthly,* the *Press,* the *Examiner* and other periodicals, and in 1876 achieved a success with 'Schopenhauer, his Life and Philosophy.' From 1887 she has resided at Florence, Italy, where she corresponds for Italian, English and American periodicals. She has also lectured in Italy, England and Germany on Italian art. Among her further publications are 'Gotthold Ephraim Lessing, his Life and his Works' (1878); 'The Epic of Kings' (1882), a paraphrase from Firdusi; a 'Life of Maria Edgeworth' (1883); 'The Hansa Towns' (1889); 'Italy of the Italians' (1906); 'Tripoli and Young Italy' (1912); 'Italian Leaders of Today' (1915); 'New Italy' (1918), etc. She also translated from Nietzsche, and Lessing's prose; edited the comedies of Goldoni (1892); was joint translator of Ferrero's essays as 'Europe's Fateful Hour' (1918), and translated Enrico Catellani's 'Italy and Austria at War' (1918).

ZIMRI, zim'ri, in the satire 'Absalom and Achitophel' (pt. i, 1681; pt. ii, 1682) by John Dryden (q.v.), a character representing Villiers, Duke of Buckingham:

> Some of the chiefs were princes in the land:
> In the front rank of these did Imri stand, etc.
> (Pt. i, 545 et seq.)

Buckingham was depicted as a factional leader, like Zimri who conspired against Asa, king of Judah (1 Kings xvi, 9).

ZINC. Zinc cast into slabs as it comes from the furnace is commercially known as spelter, but zinc recast into forms such as are used in galvanic batteries is known as battery zinc, and zinc rolled into sheets is known as sheet zinc. There is a growing movement, fostered by the American Zinc Institute, to avoid confusion by abandoning the use of the word spelter.

Properties.— Zinc is a bluish-white metal with a bright metallic lustre, an atomic weight of 65.37, a density of about seven, and a hardness, when cast, of 38 in the Brinell scale, as compared to a hardness of 40 for copper and 28 for silver. Both density and hardness are slightly increased by rolling. It is so hard that it can be filed with difficulty, and in a large mass it can be broken only with considerable force. Its texture as shown on a broken surface is prismatic crystalline, the crystals being six-sided and belonging to the hexagonal system. At different temperatures zinc has different properties. At ordinary temperatures it is fairly brittle, but at 100°–150° C. it can be rolled out into sheets or drawn into wire, though above 200° C. it becomes brittle again. It melts at 419.4° C. and boils at 920° C., the vapor burning in air with a characteristic brilliant bluish-green flame to zinc oxide, formerly known as "philosopher's wool" or "flowers of zinc." Zinc is not affected by dry air or by oxygen at ordinary temperatures, but under moist atmospheric conditions the surface becomes covered with a coating of grayish-white basic carbonate of zinc, which protects the metal from further corrosion. The industrial value of zinc for use as a protective coating for iron and steel and for use in exposed positions is due largely to this property.

Uses.— Zinc is used in metallic form in galvanizing iron and steel, in making sheet zinc, and in making brass and some other alloys. Iron and steel may be galvanized in several ways — by dipping the articles in a bath of molten zinc; by heating them to 425°–450° C. in a drum filled with zinc dust, a process known as "sherardizing," in which they are coated with zinc by the zinc vapor given off from the zinc dust; and by electroplating them with zinc. As only the last method employs the galvanic current, the others are miscalled "galvanizing," and an article protected by a coat of zinc would better be called "zinc-coated." In normal times about 60 per cent of the zinc output of the country is used in zinc-coating iron and steel. Metallic zinc may be rolled in plates an inch or so thick — "boiler plates," which, suspended in boilers, preserve them from the corrosion of sea water — or in thinner sheets for roofing, shingles, gutters, spouts, household utensils, zincographer's plates, dry batteries, buttons, shoe-lace tips, etc. Much sheet zinc was used during the European War to line packing cases filled with munitions and machined parts which needed protection from the sea air. Metallic zinc is alloyed with copper to form brass, some "bronzes" and other alloys. In normal times only about 20 per cent of the total consumption is used in making brass, but during the European War the greater part of the metallic zinc produced in the country was used for that purpose. A considerable quantity of metallic zinc is used annually in desilverizing lead by the Parkes process.

Zinc oxide is made under the French process by burning metallic zinc in an oxidizing atmosphere, and under the American process by burning oxidized or desulphurized zinc ores mixed with ground coal in an oxidizing atmosphere. The purity of the product depends on the purity of the metal and the ore. Chemically pure zinc oxide is used in pharmaceutical preparations. Zinc oxide of good grades free from lead is also used largely in making rubber, to increase its tensile strength, toughen it

and increase its wear-resisting properties. Zinc oxide of both good and common grades is used as a pigment in making paints. American process oxide, in which there is a considerable percentage of lead, i.e., leaded zinc oxide, is also used for pigment, as a combination of lead and zinc is held to be desirable in a paint.

Zinc dust, which consists of minute droplets of metallic zinc coated with a film of zinc oxide, is formed in the distillation of zinc, or is specially prepared. It is a very active chemical agent and is used to discharge the color of the pattern in calico printing. It is also used to precipitate gold in the cyanide process of gold recovery and to precipitate other metals and purify the solution in making lithopone and in the electrolytic deposition of zinc. Another use is in sherardizing as mentioned above. Lithopone, a chemical combination of zinc sulphide and barium sulphate, is a white pigment used for interior paints and forms the base of most white enamels. Several salts of zinc are employed in medicine and the arts. Zinc acetate and zinc sulphate are used in medicine as an emetic, astringent and antiseptic. They are used as a mordant in dyeing, and are also useful in wood preservation, but the chloride is generally employed for that purpose, as in the Burnett process. Zinc chloride is used as a caustic agent in the treatment of certain diseases, as a general disinfectant and preservative, and as a flux in soldering. Zinc sulphate is used in bleaching paper and as a dryer in varnishes and in fireproofing paints.

Sources.— The chief zinc minerals are zinc sulphide, sphalerite (zinc blende or "black jack"); zinc carbonates, smithsonite (calamine in Europe) and hydrozincite; zinc silicates, calamine (smithsonite in Europe) and willemite; zinc oxide, zincite ("red zinc ore"); and zinc-iron-manganese oxide, franklinite. The three minerals last named form the ore at Franklin Furnace mines, in New Jersey, where they occur more plentifully than anywhere else in the world. Zinc blende is the most common ore of zinc. It usually occurs as a complex ore in association with galena and with pyrite and other metallic sulphides, but in the Mascot mines of eastern Tennessee it is unassociated with either lead or iron. The upper parts of sulphide deposits containing zinc have usually been altered by oxidation, and the zinc minerals changed to the silicate and carbonate. The principal zinc-producing region in the United States is the Joplin district, comprising southwestern Missouri, southeastern Kansas and northeastern Oklahoma, which in 1917 produced ores containing 238,676 short tons of recoverable zinc, about 34 per cent of the total production of the country. The Franklin Furnace mines produced 119,736 tons of recoverable zinc, or 17 per cent of the total, the Butte district of Montana produced 90,145 tons, or 13 per cent, and the upper Mississippi Valley district of Wisconsin, Illinois and Iowa produced 64,027 tons, or 9 per cent. Other important zinc districts are the Cœur d'Alene district of Idaho, the Leadville district of Colorado, the east Tennessee district and the Yellow Pine district of Nevada. The total recoverable zinc content of zinc ores mined in the country in 1917 was 710,972 short tons, a large increase in response to the demands of the war, from an average of 400,000 tons in the years immediately before the war.

Canada and Mexico are well supplied with reserves of zinc ores and have exported large quantities into the United States in past years. During the early years of the European War large imports of zinc concentrates were brought to the United States from Australia, where the extensive deposits of lead-zinc ores of the Broken Hill lode of New South Wales have been for years the main foreign dependence of the zinc smelters of Belgium, Germany and France. The zinc deposits of Rhodesia Broken Hill in Africa are extensive, and there are many deposits in Algeria and Tunis. The Bawdwin deposits of India are reckoned among the largest in the world, as are also those of the Ridder and adjoining concessions in the Irtysh region of southwestern Siberia. The chief zinc-producing regions of Europe are the Upper Silesia district, formerly a part of Prussia; the Rhine district of Germany; the island of Sardinia in Italy, and the Santander and Cartagena districts of Spain.

Before the complex ores, sulphides of zinc, lead, copper and other metals — the refractory ores of the metallurgist — are treated in the usual practice by smelting in the blast furnace, the zinc minerals must be separated from the others because zinc interferes so greatly with the reduction of the other minerals that a "fine" or "penalty" is placed by the smelter on ores containing zinc above a fixed limit, depending on circumstances. Moreover, the zinc is lost. Hence practically all zinc-bearing ores are subjected to milling, in which the zinc minerals are separated from the others and all are concentrated to workable richness. In the Joplin region ore of lower metallic content than anywhere else in the world is profitably mined. In one type of deposits, the "sheet ground," the ore mined in 1916-17 averaged 1.3 per cent of zinc and 0.3 per cent of lead, as shown by the metal content of the concentrates. The zinc concentrates average from 58 to 59 per cent of zinc. In the Broken Hill district of New South Wales in early years the zinc was separated as middlings and accumulated in huge stacks. By the flotation process, perfected in that region since 1903, the sulphide minerals are floated off in a froth while the gangue minerals sink to the bottom. The stocks of zincky middlings thus became available and have furnished the bulk of Broken Hill's large annual output of zinc concentrates in recent years. The flotation process has likewise made available large reserves of lead-zinc ores previously unworkable in various parts of the world.

Zinc Smelting.— The origin of the art of smelting is lost in the mists of antiquity. Brass was an article of commerce with the Orient from the earliest days of which there is record, but brass can be made by the "cementation" process in which granulated copper is melted with granulated "calamine" (oxidized zinc ore), and hence the existence of brass is not proof of the production of metallic zinc. However, metallic zinc was certainly known in India in the 14th century. Zinc ore may be reduced by burning off the zinc as oxide, and the oxide may be utilized as such or may be dissolved and the zinc content deposited

electrolytically; or the desulphurized ore may be leached with sulphuric or other acid and the zinc obtained by electrolysis. Both these methods are in commercial use, and other electrochemical processes are in a fair way to be established. Electrothermic reduction of zinc ores is practised in Sweden, but has not yet proved commercially feasible in the United States. The low volatilization point of zinc led to distillation as the first method for the reduction of zinc ores, and it is yet the chief method. The native Chinese method of making zinc, though primitive, nevertheless, involves all the essential principles of modern zinc distillation. Clay pots or crucibles are set in the flat top of the furnace so that the lower half is exposed to the heat of the furnace. The zinc ore and carbon are put into the pot, a sloping partition with a perforation at the upper edge is luted (sealed with clay) into position at the middle of the pot, and the cover is luted on. The zinc vapor comes up through the perforation, condenses in the cooler upper chamber and collects as liquid zinc on the lower portion of the sloping partition, whence it may be dipped and cast into cakes. In the modern retort furnace there may be 300 to 450 clay retorts set in three to five horizontal rows, each retort about 10 inches in diameter and about five feet long. Two such furnaces are joined back to back in a block. Only the mouth of the retort projects from the furnace, and to this is luted the condenser, a conical clay cylinder closed at the slightly lower front end, except for a small aperture, by a clay plug. The zinc vapor distils over and is liquefied in the condenser, from which it is "drawn" and cast into slabs four times during the "campaign," which lasts 24 hours, the retorts being cleaned out and the charges renewed each morning.

Production.— World's production of metallic zinc in 1913, in short tons was a follows:

Australia	4,105
Austria	23,928
Belgium	217,928
France	71,672
Germany:	
Silesia	124,552
Rhine district	187,522
Great Britain	65,197
Holland	26,811
Norway	10,237
Russia	8,389
Spain	6,617
United States	346,676
Total	1,093,634

In 1913 the United States ranked first in production, with 31.7 per cent, and first in consumption, with 27.7 per cent. The other large consumers were Germany, 22.9 per cent; Great Britain, 19.2 per cent; France, 8.1 per cent, and Belgium, 7.5 per cent.

The production and consumption of metallic zinc in the United States during the European War as compared to the average of the four years immediately preceding the war is here shown, in short tons.

	1910–1913 (average)	1914	1915	1916	1917	1918
Production of primary zinc:*						
From domestic ore	296,315	343,418	458,135	563,451	584,597	492,485
From foreign ore	13,983	9,631	31,384	104,005	84,976	25,522
	310,298	353,049	489,519	667,456	669,573	517,927
Production of secondary zinc:*						
Redistilled	19,721	20,545	29,764	29,663	16,835	9,918
Remelted	26,302	22,424	23,136	21,037	14,565	17,190
	356,321	396,018	542,419	718,156	700,973	545,035
Apparent consumption of primary zinc	290,413	299,125	364,632	458,428	413,643	423,356

* "Primary zinc," which is produced from ore, is distinguished from "secondary zinc," which is obtained by refining zinc ashes, skimmings, drosses, and old metals and which has already been statistically counted as metal.

The first zinc was made in the United States in 1835 by Dr. F. R. Hassler, superintendent of the United States Coast Survey. Finding it impossible to obtain abroad brass or zinc of the requisite purity for the standard sets of weights and measures he set up a small zinc-distillation plant in the arsenal at Washington. The ore used was a mixture of blende from Perkiomen, Pa., and red zinc ore from Franklin Furnace, New Jersey. The first zinc smelting on a commercial scale was at the Lehigh works at South Bethlehem, Pa., in 1860. In the same year the Matthiessen and Hegeler works were opened at La Salle, Ill. These were the main eastern and western centres of zinc smelting until 1892, when smelters in the coal fields of Kansas assumed equal importance with Illinois plants. This importance was increased about 1896, when natural gas began to be used for smelting, and by 1899 Kansas had become the largest producer among the States. The waning of the gas fields caused Kansas to fall behind Illinois in 1913, but for the last two years the natural-gas smelters of Oklahoma, which first smelted zinc in 1907, have held that State in the front rank. (See ELECTROCHEMICAL INDUSTRIES; METALLURGY; METALS). Consult Holley, C. D., 'Lead and Zinc Pigments' (New York 1909); Ingalls, W. R., 'Production and Properties of Zinc' (ib. 1902); id., 'Metallurgy of Zinc and Cadmium' (2d ed., ib. 1906); id., 'Lead and Zinc in the United States' (ib 1908); 'Mineral Industry' (annual vol., New York); 'Mineral Resources of the United States' (annual vol., United States Geological Survey, Washington, D. C.).

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ZINC, Refining of. See ELECTROCHEMICAL INDUSTRIES.

ZINC WHITE. See WHITE COLORS.

ZINCITE, or KINKITE, a deep blood-red to orange-red mineral found quite abundantly in Sussex County, N. J. It is

government sent him back under a military escort to the frontier. He afterward visited Holland, spent several years in England, and obtained an act of Parliament for the protection of his followers in the British dominions. He wrote more than 100 works in prose and verse. A collection of his hymns, edited by Knapp, appeared in 1845. His 'Diary' was published (1907). Consult the 'Lives' by Spangenberg, A. G. (1772–75); Eng. trans., abridged, London 1838) and Römer, H. (Gnadau 1900); also, Plitt, H., 'Zinzendorf's Theologie' (3 vols., Gotha, 1869–74), and Becker, B., 'Zinzendorf und sein Christentum im Verhältnis zum kirchlichen und religiösen Leben seiner Zeit' (1886; 2d ed., Leipzig 1900) · Williston, W., 'Great Men of the Christian Church' (Chicago 1908).

ZION, or SION, the loftiest mount of Jerusalem, and often used in biblical and other literature to designate the whole city, and metaphorically the kingdom of God on earth and in heaven. Zion rises about 2,500 feet above the Mediterranean, and from 200 to 300 feet above the valleys at its base. It was separated from Akra on the north and Moriah on the northwest by the Valley Tyropœon, and had the valley of Gibbon on the west, that of Hinnom on the south and that of the Kidron on the southeast. It was a fortified town of the Jebusites till subdued by David, and thenceforward was called the "City of David" (2 Sam. 6–7). A mosque near its southern brow now covers the "tomb of David" so-called. This mount, together with Moriah and Ophel, was enclosed by the first wall, and fortified by citadels. On it were erected the palaces of Solomon, and long afterward those of Herod. At the present day a considerable portion of it lies outside of the modern wall on the south.

ZION CITY, Ill., city in Lake County, 40 miles north of Chicago, on the Chicago and Northwestern Railroad. Manufactures include lace, bricks and candy, and office, milling, baking and electrical supplies. Pop. 4,789.

ZION NATIONAL MONUMENT. A government reservation in the southwestern part of Utah. Its area is 76,800 acres. It comprises the upper part of the valley of the Virgin River which here flows for eight miles in a narrow canyon with walls in places 2,500 feet high, of brilliant colors and with great variety of gorgeous cliffs, towers and pinnacles. Notable among these are two great pinnacles known as the Temples of the Virgin and also as the Gates of Zion; they rise 4,000 feet above the valley and consist of sandstone, red in large part, capped by gleaming white. They were discovered by J. W. Powell in 1864. While the reservation is a long distance from the railroad, being 90 miles from Lund, the nearest point on the Salt Lake Line, it is accessible by good auto roads and a camp for tourists is maintained by the Wylie Company.

ZIONISM. See JEWS AND JUDAISM — ZIONISM.

ZIPAQUIRA, sē-pä-kē-rä', Colombia, town, department of Cundinamarca, 25 miles north of Bogota. It is built on the site of an old Chibcha Indian town, which was the residence of the chiefs of *Zipas*. It is especially noted for its valuable salt bed which is owned and operated by the government, and supplies the greater part of the salt used in the republic. Coal, lead, copper and iron are also found in the vicinity, and the town carries on an active trade with the surrounding district. Pop. (district) 12,000.

ZIPH. See ZIF.

ZIRCON, the native zirconium silicate, $ZrSiO_4$. Its crystals are tetragonal and isomorphous with thorite, xenotime, cassiterite and rutile. Though its crystal forms are very varied, they are usually prisms terminated by pyramids, the base being rare. Small crystals frequently show a wealth of faces, among which the "zirconoids; or ditetragonal pyramids are prominent. It is a heavy mineral, its specific gravity averaging about 4.7, and it has a characteristic greasy-adamantine lustre. Though often nearly or quite opaque, transparent crystals are not uncommon, and owing to its hardness, 7.5, strong double refraction and the variety of rich colors in which it is found, zircon has long been prized as a gem. Its dispersive power is excelled only by the diamond. "Hyacinth" or "jacinth" includes reddish, orange or brownish gem stones, while "jargon" embraces the colorless, yellowish, grayish or smoky varieties. It is often an important accessory constituent of gneiss, syenite and many crystalline rocks. Because of its resistance to weathering and abrasion it frequently occurs in fine little crystals in alluvial sands as in Ceylon, Brazil and the monazite region of North Carolina. The finest zircon gems come from Ceylon and New South Wales, while France yields very small stones of remarkably fine red color. Excellent translucent to opaque crystals occur in Norway, the Ural Mountains, Canada (up to 15 pounds), in New York, New Jersey, Colorado and North Carolina. By far the most important locality is in Henderson County, N. C., where many tons of crystals occur loose in the soil. Zirconia, derived from this source, was used in the "Welsbach" or "Auer" mantles, but its incandescence had not sufficient permanency and its use has been superseded by thoria. Zirconia is still useful as a refractory material in furnace and crucible linings, and because of its incandescence in the "zircon light," which is an improvement on the ordinary lime light.

ZIRCONIUM, a chemical element named after the mineral zircon in which Klaproth discovered the oxide zirconia (1789), and obtained by Berzelius in 1824 as an iron-gray powder. Afterward found in many other minerals, some of the most important being eudialyte, hyacinth, polymignite, etc. It has many physical and chemical properties resembling the element silicon. Like silicon and carbon it exists free in three allotropic forms; the amorphous, obtained as a black powder by heating sodium zirconium chloride with metallic sodium or potassium; the crystalline, as foliated leaves from heating sodium zirconium fluoride with metallic aluminum; and the graphitoidal, obtained in scales of a steel gray color by action of iron on sodium zirconium. Symbol Zr; atomic weight 90.7; specific gravity 4.15. The element is only slightly soluble in hydrochloric or sulphuric acids, but is readily so in aqua regia or hydrofluoric acid. When heated highly in the air it burns to the

oxide ZrO_2. This oxide, commonly known as zirconia, is prepared by fusing the mineral zircon ($ZrSiO_4$) with a mixture of sodium hydrate and sodium carbonate, treating with hydrochloric acid and heating to separate the silica, precipitating the solution so obtained with ammonia, and heating this white precipitate. Another method is now used by which the chloride is made by treating crushed zircon with chlorine, separating the silicon chloride by heat, precipitating the solution of zirconium chloride with ammonia, and heating the precipitate. Zirconia forms a white powder or amorphous lumps. It has both basic and acid properties. It dissolves slowly in hydrofluoric or sulphuric acids, the fluoride (ZrF_4) uniting with fluorides of other metals forming complex salts called zircofluorides, example K_2ZrF_6, potassium zircofluoride. With strong alkalies zirconia forms zirconates, example, K_2ZrO_4, potassium zirconate. Zirconium forms a long series of salts, in most of which it acts as a basic element.

Uses.— Zirconia possesses the power of being extremely refractory toward heat, not being changed even by that of the oxy-hydrogen blowpipe flame. It also has great radiating power. Because of this it is used in the "zirconia light," a light used considerably in lighthouses. A cone of zirconia is played upon by the very hot flame of the oxy-hydrogen blowpipe so that it glows with a very intense white light. While this is the principal use of compounds of zirconium, certain minerals containing it are found as clear beautiful stones and are used as gems.

ZIRKNITZ, tsĭrk'nĭts, or **ZIRKNITZER ZEE**, or **CZIRKNITZER SEE**, Austria, a phenomenal periodical lake in Carniola, 30 miles east-northeast of Trieste, in a deep valley surrounded by mountains, the principal of which are Javornik, Succhi, Slivinza and Sternitz. The lake takes its name from Zirknitz, situated at an elevation of 3,500 feet, and one of many villages in the neighborhood. Receiving the waters of six streams, and surrounded by mountains with no outlet, the characteristic feature of the lake is its internal drainage. The bottom of the lake partakes of the limestone formation of the district, which fissures readily, and has numerous subterranean caves and channels. Some of these caverns are of great depth, and in the dry season absorb the waters of the lake, leaving it sometimes completely dry, with only a few pools, in which the fish take refuge. A luxuriant natural vegetation covers the surface of the deserted lake, and when the drought is protracted grass, millet, or buckwheat is sown on it and the harvest reaped before the return of the water. In June the lake is frequented by wild ducks, which afford abundant sport, and when the water is decreasing fish are caught in great numbers. The lake is from six to seven miles long, nearly three broad and of an average depth of 11 feet, but there is no stated limit to its basin. It receives the drainage of a considerable country, and even when no rain falls in the immediate neighborhood its reservoirs are filled from the rainfall of more distant hills. In dry seasons the lake takes about 30 days to empty. When rain has been abundant and all its subterranean sources are in simultaneous activity, it reaches the average height in 72 hours, and when the rain has extended to all the tributary region it reaches its extreme level, which is about two feet above the average, in 196 hours. The natural outlets then no longer suffice to carry away the water, and it overflows the country, damaging or destroying the surrounding villages. The emptying and flooding of the lake depends upon the drought or moisture of the season, and is not strictly periodic. It has been known to empty and fill three times in one year. From 1707–14 it was only once dry, and from January 1834 to February 1835, it remained entirely without water, the longest drought on record. This lake was known to the ancients for the same phenomena, the Romans calling it *Lacus Lugens* or *Lugea Palus;* and it has been picturesquely described by Tasso in his 'Sette Giornate del Mondo.'

ZISKA, zĭs'kȧ (properly **ŽIŽKA**, zhĭzh'kȧ), **John**, Bohemian Hussite leader: b. Trocznov, near Budweis, about 1360 (by some authorities as late as 1380); d. Přibyslav 11 Oct. 1424. He was educated at the court of King Wenceslas at Prague, entered the profession of arms, joined the contingent that went from Bohemia and Hungary in 1410 to the assistance of the Teutonic Kinghts against the Poles and Lithuanians, and fought with great prowess in the fiercely contested battle of Tannenberg, 15 July 1410. Then he served in Hungary against the Turks, and with the English at Agincourt, 25 Oct. 1415. Soon after the execution of Huss (q.v.), he returned to Bohemia and became a leader of the Hussites. In 1419, when the Hussites broke into rebellion against the Emperor Sigismund, Ziska organized their military forces into a well-disciplined army of infantry, supplying the want of cavalry by means of the Waggenburgen, or "car-forts," constructed of the baggage-wagons. He took up his headquarters at a stronghold on the heights of Austie, in southern Bohemia, the fortress being known as Tabor (with reference, perhaps, both to *tabor*, Bohemian for "encampment," and to Mount Tabor in Palestine), and the extreme Hussites as "Taborites." Sigismund sent an army of 30,000 into the country, but Ziska, with a hasty levy of about 4,000, took up his position on Mount Vitkov, near Prague, and on 14 July 1420 defeated the enemy with great slaughter. The eminence has since been known as the Hill of Ziska. On 1 Nov. 1420, at Pankratz, he was again victorious over Sigismund, and on 2 November captured the fortress of Vyšehrad, near Prague. He won a second great battle against Sigismund 8 Jan. 1422 at Deutschbrod, and penetrated into Moravia and Austria. He had long had but one eye, and lost the other by an arrow-wound at the siege of Raby castle in 1421. Notwithstanding his blindness he continued to direct his troops with great efficiency and almost unvarying success. Prague refused to recognize his authority, and he thoroughly subdued it in 1424. In that year, it is said, Sigismund, realizing the impossibility of conquering Bohemia, began negotiations toward a treaty, by the terms of which the Hussites were to have full religious liberty and Ziska was to be governor of Bohemia. Such negotiations, if undertaken, were interrupted by Ziska's death at the siege of Přibyslav.

Ziska became the hero of the Bohemian revolutionary party, and for this character he was well fitted by his zeal and military ability. He was frequently cruel in his method of warfare and conquest. Much fiction has been mingled with the facts of his career. Alfred Meissner's epic 'Ziska,' based on the leader's history, reached a 12th edition in 1884. Consult the German translation (1882) of Tomek's 'Life.'

ZITHER, or **CITHERN,** a modern development of the musical instrument known to the Greeks as cithara. In the early part of the 19th century it became a favorite with the peasantry of the Styrian and Bavarian Alps, and was introduced into England about 1850. The zither consists of a resonance box, with a large circular sound hole near the middle; the strings, 32 in number, in some cases increased to 40 and even 46, being made of steel, brass, catgut and silk covered with fine silver or copper wire, and tuned by pegs at one end. Five of the strings are stretched over a fretted keyboard, and are used to play the melody, the fingers of the left hand stopping the strings on the frets, the right-hand thumb, armed with a metal ring, striking the strings, which are tuned in fifths, and have a chromatic range from C in the second space of the bass staff to D in the sixth ledger line above the treble. The remainder, called the accompaniment strings, are struck by the first three fingers of the right hand. The viola zither, in which the resonance box is heart-shaped, is tuned like the violin, and is played with a bow.

ZITTAU, tsit'tow, Germany, a town of Saxony, on the Mandau, near the Austrian frontier, 49 miles by rail east-southeast of Dresden. The town was practically destroyed in the Seven Years' War, since which time most of its buildings have been erected. The chief public buildings are a splendid town-house, the churches of Saint Peter, Saint Paul, Saint John and Mary, hospitals, custom-house, gymnasium, a municipal museum, and a valuable library. Its principal manufactures are cotton-spinning, dress goods, iron-founding machinery, stained glass, cycles, ropes, paper, brewing and brick-making; and there is a trade in cotton and linen goods, chemicals, etc. There are a number of lignite mines in the neighborhood. Pop. 34,719.

ZITTEL, tsit'tĕl, **Karl Alfred von,** German palæontologist and geologist: b. Bahlingen, Baden, 25 Sept. 1839; d. Munich, Bavaria, 6 Jan. 1904. After study at Heidelberg and Paris, he entered the geological survey at Vienna, in 1863 became a lecturer in the university there, and later in the same year was appointed professor of mineralogy at Karlsruhe. In 1866 he was made professor of palæontology and geology at Munich; and from 1899 he was president of the Bavarian Academy of Sciences and curator-general of the scientific collections of Bavaria. The Rohlfs expedition, which he accompanied to Egypt and the Libyan desert in 1873–74, derived much of its value from his important labors. Among his publications are the 'Palāontologische Studien uber die Grenzschichten der Jura- und Kreideformation' (1868-83); 'Aus der Urzeit' (1872; 2d ed., 1875); 'Handbuch der Palāontologie' (5 vols; 5th vol. with Schimper and Schenk, 1876–93), the most complete and authoritative work in that field; and 'Geschichte der Geologie und Palāontologie bis Ende des Neunzehnten Jahrhunderts' (1899). He edited the periodical *Palæontographica* from 1869.

ZIWET, Alexander, American mathematician: b. Breslau, Germany, 8 Feb. 1853. Graduated from the Polytechnical School of Karlsruhe in 1880, he came in that year to the United States, and for some time was connected with the United States lake survey (Detroit) and the coast and geodetic survey (Washington). Subsequently he became successively instructor in, and junior professor of, mathematics in the University of Michigan, where he has been professor since 1905. In 1892 he was made co-editor of the *Bulletin* of the American Mathematical Society. He published an 'Elementary Treatise on Theoretical Mechanics' in three parts, as follows: Pt. I, 'Kinematics' (1893); Pt. II, 'Introduction to Dynamics, Statics' (1893); Pt. III, 'Kinetics' (1894; revised ed., 1904).

ZIZANIA, a genus of grasses (q.v.) including the wild rice.

ZIZYPHUS, a genus of the family *Rhamnaceæ,* shrubs or small trees, with spiny stipules, alternate three-nerved leaves, a spreading five-cleft calyx, five hood-like petals, five stamens, a five-angled disc, adhering to the tube of the calyx, and having enclosed within it the two- or three-celled ovary. Fruit a drupe, which is sometimes edible and has a large stone or kernel containing from one to several flattened seeds. *Zizyphus* is widely distributed, but is chiefly indigenous to tropical Asia and America. The fruits of the cultivated *Z. jujuba,* and of *Z. sativa,* are of the size and shape of a small, oval plum. They ripen in September when they are gathered and stored in a dry place, the pulp becoming sweeter by the process. They have a dark-red skin, but are yellow within. If carefully dried, these fruits, called jujubes, will keep for a long time, and retain their acid flavor, which has made them a refreshing dessert fruit, in the Mediterranean countries and in China. They are nutritive and demulcent, a cough medicine having been prepared from them, and formerly the sweet-meat known as jujube paste was made from the evaporated juice of jujube, and of gum-arabic; but now the jujube is displaced by the gum and by gelatine. *Z. sativa* is a handsome arborescent shrub, with small, varnished, oval leaves and greenish inconspicuous flowers, succeeded by the bright drupes. It is sometimes cultivated in the United States, being hardy as far north as Washington. The bark, in its native countries, was used medicinally, for fever and for sores; and it is also employed for tanning and for a dye-stuff like that of *Z. xylopyra* which yields a black dye. Various parts of other species yield medicines, and the edible fruits of *Z. baclei* of Africa are used for a pleasant drink and are also made into bread. *Z. lotus* is by some believed to be the lotus-trees the fruit of which produced such indolence in those who ate them. It grows in Barbary,

where it is called sadr. *Z. spinachristi* is a small, prickly tree, which is reputed to have composed Christ's crown of thorns. Like other spiny species of *Zizyphus*, this is a good hedge plant. *Z. nummularia* of Persia and India is one of the camel's thorns, whose foliage forms a fodder, and which has edible fruits. The cog-wood of Jamaica, an important timber tree, is *Z. chloroxylon*.

ZLATOUST, zlä-tō-oost', Russia, a town in the province of Ufa, on the Ai, an affluent of the Ufa, near the Ural Mountains, 150 miles direct and 199 miles by railway northeast of Ufa. It has a cathedral and a meteorological and magnetical observatory. In the vicinity are rich iron and gold mines, and in the town are government works, manufacturing sword-blades, steel instruments and ammunition. Pop. about 34,245.

ZNAIM, tsnīm (formerly **ZNOIMO** or **ZNOJMO**), Austria, a town of Moravia, on the Thaya, 50 miles northwest of Vienna. The chief buildings are a Rathhaus (1446), a circular church, said to have been a heathen temple, and the Gothic church of Saint Nicholas, dating from 1348. The old ducal castle crowns a neighboring height. The trade is largely agricultural. Mustard, wine and cucumbers are exported. Fine majolica, leather and chocolate are manufactured. New waterworks were opened in 1877. As Znoimo, it was the capital of Moravia, destroyed in 1145 by the Bohemian Prince Vladislav, and rebuilt in 1226. On 11 July 1809, the French under Massena and Marmont defeated the Austrians here, resulting in the armistice between Napoleon and Archduke Charles; it was captured by the Prussians 13 July 1866 and was occupied by them until 3 Sept. 1866. Pop. about 18,828.

ZOANTHARIA, an order of *Actinozoa* (q.v.) characterized by the fact that the tentacles are simple and unbranched, that there are usually incomplete as well as complete mesenteries, and that the tentacles usually alternate in several circles. The mesenteries and tentacles are often arranged in multiples of the number six, but this is variable, and in some forms the number of mesenteries increases during the growth of the animal. The animal develops as a gastrula, the blastapore of which remains as the mouth. The larva is usually ciliated and free-swimming. The Zoantharia include the sea-anemones and corals (qq.v.); these do not represent natural divisions of the class, but merely modes of life of its members. A colonial Zoantharian with a calcareous exoskeleton is a coral; an isolated Zoantharian without an exoskeleton is a sea-anemone.

ZOAR, Palestine, an ancient city mentioned in the Bible, but whose exact location is unknown, although it probably stood at the southern end of the Dead Sea. It is spoken of as visible from Pisgah (Deut. xxxiv, 3). The Arabic historian Abulfeda speaks of a Zoara near the Dead Sea, and the Roman garrison, Zoara, mentioned by Jerome and Eusebius, is probably the same place. Mention of it occurs in Genesis xiv and xix; in Isaiah, xv, and in Jeremiah xlviii. Consult Smith, G. A., 'Historical Geography of the Holy Land' (16th ed., London 1910).

ZOAR, zō'ar, Separatists Society of. The Separatists Society of Zoar was a communistic religious organization located at Zoar, on the Tuscarawas River, Tuscarawas County, Ohio. They were German Protestant peasants, 225 in number, who emigrated from Württemberg in April 1817. Their chosen leader was Joseph Baumler, whose name was later changed, for the sake of euphony, to Bimeler. Bimeler was of humble origin, but a man of unusual ability and independence, well educated, a natural leader, and a fluent speaker; he purchased in his own name, in the locality named above, 5,000 acres of farm land, at an average value of $3 per acre, giving a mortgage at long time for the entire amount. This Separatist emigration had been primarily for the purpose of securing religious liberty; and for better opportunities in obtaining a livelihood. It was expected that each family would, by its industrious labor, secure separate ownership in a portion of the land held by Bimeler, but the colonists being diverse in age, strength, experience, education and enterprize, they soon realized that their personal inequality stood in the way of the collective success of the colony, and early in 1819 they decided to organize into a community of property and effort. Articles of agreement were signed by 159 adults — 53 males and 104 females. The articles created a community of interest, present and prospective, whereby all the property, movable and immovable, of the individual members, and their future earnings should become the common stock of the association, to be held and managed by chosen directors. Death of a member passed no property interest to his heirs, and withdrawal from the society, voluntary or compulsory, carried with it no claim upon a divided or undivided right in the association. Bimeler was to retain the realty in trust until the societey by its earnings could pay the mortgage and assume title.

In 1832 the society reached its highest membership of 500, and was incorporated under the then existing laws of Ohio by the name of "The Society of Separatists of Zoar." This conferred upon the society the ordinary powers of a corporation, with perpetual succession, power to hold property, purchase and sell, pass by-laws, etc. Under this reorganization the members were divided into two classes, known as the novitiates and the full associates; the novitiates were obliged to serve at least one year before admission to the second class, and this applied to the children of the members if, on becoming of age, they wished to join the society; the full associates must be of legal age — the males 21 and the females 18; all officers were elected by the whole society, the women voting as well as the men, all elections being by ballot and a majority vote; the government of the community vested solely in a board of three trustees (or directors) to serve three years each, one to be elected annually; these trustees had unlimited power over the custody and management of the property and all the temporalities of the society, but were bound to provide clothing, board and dwelling for each member "without respect to person," and use all means

confided to their charge for the best interests of the society; they directed the industries and detail of affairs of the society; assigned each member his especial work, and the portion of necessaries each should receive. Beside the board of trustees there was a standing committee, or council, of five, one member being elected each year. This council was the supreme judiciary, or board of arbitration, of the society, in cases of disagreement, dissension or complaint; it had power to excommunicate members or deprive them of participation in the affairs of the society. They also elected once in four years a cashier or treasurer who had custody of all moneys, kept the books, and had immediate oversight over the finances of the society. In addition there was an official known as the "agent general," who acted as the trader to buy and sell for the society in its dealings with the outside world, make and enforce contracts, etc. The office of agent general was regarded as the position of honor and influence, and to it Joseph Bimeler was elected for life; after his death the office remained vacant, its duties being performed by the cashier or the trustees.

The society, from its organization as a commune, steadily prospered, and in time built up a large number of enterprising and successful industries, having in the period of its height two large flour mills, saw mill, planing mill, machine shop, tannery, dyehouse, stove foundry, cooper shop, woolen mill, brewery, slaughter-house, blacksmith shop, tile works, pottery, etc. In all these concerns a high grade of goods was produced which found a ready market with foreign customers. The value of the Zoar property increased until about 1875, when their land, industrial plants and money accumulation were estimated at $1,500,000. From that time the enterprise began to decline. Bimeler died in 1853, and there was no leader or director his equal in sagacity or personality. The environment of the society slowly changed from that of a western pioneer frontier to a prosperous, cultivated section of country, and rival neighboring industries made inroads into the export business of Zoar; the Zoarites were not progressive and did not keep pace in their manufactures with modern methods and improvements, and in time found that they could purchase products for use and wear cheaper than they could make them; there were few accessions to the society; the original members became too old and feeble to conduct its affairs; outside laborers had to be employed; the younger members were inclined to leave and seek their fortunes where they could acquire independent property and freedom of action. This decline continued until in 1897, when, by a common consent, the organization decided to disband and place the property in the hands of a commission for equal division. The appraisement and distribution was completed in the fall of 1898. There were at this time 222 people, adults and children, in the society, of whom 136 were entitled to one equal share. They each received a few hundred dollars in cash and a portion of the farm land or village property.

The religious tenets of the Zoarites were few and simple. They confessed the doctrine of the Trinity; the fall of man, the return through Christ, the Holy Scriptures as the guide of their lives, all ceremonies were declared useless and injurious, marriages were contracted by mutual consent and before witnesses, they recognized no ordained minister, and engaged in no public prayer. Bimeler was their only preacher and teacher, he spoke each Sunday to the society, and after his death his published discourses were read in the public meetings by various members. The society did not seek additions and made no attempt to propagate its principles, either economic or religious. The life of the Zoarites was one of utmost simplicity, serenity and morality. There never was a divorce in the community and no member was ever charged with a crime or felony. Consult Nordhoff 'Communistic Societies in United States' (1875); and Randall, 'History Zoar Society' (1904).

ZOBEIR, or **ZUBAIR, IBN al Awam,** a relative of Mohammed, and one of the earliest converts to Islam: d. 656. He was one of the 10 predicted by Mohammed as certain to enter the Garden of Allah. Before his death, Omar, successor of Mohammed, appointed Zobeir one of a council of six who were to choose from their own number a new caliph. Zobeir opposed the election of Othman and was thereafter his enemy; he also opposed his successor, Ali, with whom he had been friendly before Ali's accession. Later Zobeir succeeded in raising a rebellion against Ali, and he was slain at the battle of the Camel, at Basra. For his son see ABD ALLAH IBN ZUBAIR. Consult Huart, C. I., 'Histoire des Arabes' (Paris 1912).

ZOBEIR, Rahama, Egyptian pasha and Sudanese governor: b. 1830. He came of a family claiming descent from an uncle of Mohammed. By 1860 he had established his leadership among the Arab ivory and slave traders on the White Nile and in the Bahr-el-Ghazal, and although nominally an Egyptian subject he maintained a great army of blacks and was the real ruler of the surrounding country. He defeated an expedition sent from Khartum to Bahr-el-Ghazal in 1869, but pleaded innocence in the matter, was pardoned and appointed governor of the district. In 1874 he conquered Darfur, and was made governor-general of the new province, but when he went to Cairo in 1876 the authorities prevented his return. His son assumed his place in Bahr-el-Ghazal, and under the instruction of Zobeir defied the forces of General Gordon, and in 1878 was subdued. In 1884, however, General Gordon, apprehensive of the Mahdist movement, vainly asked that Zobeir be permitted to return in order to check it. Zobeir was interned at Gibraltar in 1885–87, returned to Cairo in 1887, and after 1899 lived on his estates in his native country.

ZÖCKLER, tsĕk'lĕr, **Otto,** German Lutheran theologian: b. Grünberg, Hesse, 27 May 1833; d. Greifswald, 9 Feb. 1906. He was educated in the universities of Giessen, Erlangen, Halle, Göttingen and Berlin, became a lecturer at the first-named in 1857, and in 1863 professor of theology. In 1866 he was appointed professor at Greifswald, and in 1885 consistorial councillor. He was one of the leaders of the movement toward the establishment of a state church in Prussia. In 1882 he became editor of the

Evangelische Kirchenzeitung. For the 'Kurzgefasstes Kommentar zum Alten und Neuen Testament und zu den Apokryphen' (1886 et seq.), which he edited with Strack, he prepared the commentaries on the Old Testament apocryphal books, the Acts, and the epistles to the Thessalonians and Galatians. Among his works are 'Hieronymus, sein Leben und Wirken' (1865); commentaries to Chronicles, Job, Proverbs, Ecclesiastes, Canticles and Daniel, in Lange's 'Bibelwerk' (1866–72; Eng. trans. 1870 et seq.); 'Das Kreuz Christi' (1875; Eng. trans. 1877); 'Gottes Zeugen im Reich der Natur' (1881; 4th ed., 1906; Eng. trans. 1886); 'Biblische und Kirchen-historische Studien' (1893); 'Die Tugendlehre des Christentums' (1904); 'Geschichte der Apologie des Christentums' (edited by H. J. and E. Schlapp, 1907), etc.

ZODIAC. The zodiac is a belt of the celestial sphere, extending 8° on each side of the ecliptic, or the path of the sun among the stars. "The name is derived from ζῶον a living creature, because the constellations in it (except Libra) are all figures of animals. It was taken of that particular width by the ancients simply because the moon and the then known planets never go farther than 8° from the ecliptic" (Young's 'Astronomy'). The belt is divided into 12 parts, of 30° each, to which are given the following names: Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, Pisces. This division into 12 parts was suggested by the 12 reappearances of the moon in a year. The idea seems to have originated with the Chaldæan astronomers, about 2100 B.C.

Owing to the fact that the earth is not a perfect sphere, the pole of the earth's equator describes a circle around the pole of the ecliptic, which causes a constant retrograde motion in equator with the point of intersection of the plane of the zodiac. The rate of this motion is 1° in 70 years, and has amounted to 30°, or one entire sign, up to the present time. "The sign of Aries, therefore, is now in the position of the constellation Pisces; each sign having backed so to speak into the constellation west of it." The constellations themselves bear no resemblance to the signs designated by them.

During the Middle Ages the signs of the zodiac were supposed to influence human life, and hence were distributed to different parts of the human body. Disease was supposed to be cured by the aid of the zodiacal power presiding over that part of the body. The remnant of this superstition is still seen in some almanacs.

The Egyptians are supposed to have adopted the 12-fold division of the Zodiac from the Greeks, but they changed the symbols of living creatures to others of their own. The Chinese divided the course of the sun into 12 parts, which they designated as the rat, the ox, the tiger, hare, dragon, serpent, horse, sheep, monkey, hen, dog and pig. This division is still found in some parts of Central Asia and Japan. It has also been found among the remains of the Aztec race in America. The original zodiacal constellations occupied unequal spaces in the heavens. Hipparchus was the first to divide the zodiac into equal spaces of 30° each, and give to them the names of the older constellations. His method of reckoning positions in the ecliptic was used until this century. Astronomers have now abandoned it for the more accurate measurement of degrees, beginning at the vernal equinox.

The origin of the names of the animals assigned to the zodiac by the ancients is unknown. Some have supposed that the spring signs: Aries, the Ram, Taurus, the Bull, and Gemini, the Twins, mark the time of the bringing forth of young by flocks and herds. Cancer, the Crab, marks the time when the sun appears to move backward. Leo, the Lion, symbolizes the fierce heat of summer, and Virgo, the Virgin, gleaning corn, symbolizes the harvest. In Libra, the Balance, the day and night balance each other. Scorpio is supposed to have marked the presence of venomous reptiles in October; while Sagittarius symbolizes the season of hunting. Capricornus marks the beginning of the return of the sun to the north, Aquarius symbolizes the winter rains, and Pisces the season of fishes. These are but fanciful representations, and have no foundation in fact.

ZODIACAL LIGHT. "The zodiacal light is a faint column of light rising from the western horizon after twilight in winter or spring evenings; and before daybreak in summer or autumn. It extends out on each side of the sun, and lies nearly in the plane of the ecliptic. Near the equator it can be seen all the year, and has been traced all the way across the heavens from east to west, forming a complete ring." In our latitudes it can seldom be traced more than 90° from the sun. Parts of the column near the sun are somewhat bright, but distant portions are extremely faint, and can only be seen on the very clearest nights; though the cause of the zodiacal light cannot be said to have been definitely proved, it is very probable that it is sunlight reflected by myriads of small meteoric bodies revolving around the sun, nearly in the plane of the ecliptic. This theory requires a thin flat ring of these meteors to extending beyond the orbit of the earth. The name zodiacal light was given to this phenomenon by Cassini in 1653, who described it as a flat luminous ring encircling the sun nearly in the plane of the ecliptic. Kepler supposed it to be the atmosphere of the sun; but Laplace showed that the atmosphere of the sun could not extend to anything like the distance from the sun which is reached by the zodiacal light. In 1853 an extended series of observations was made by Jones from different parts of the Pacific Ocean. From these observations he deduced the theory that the zodiacal light was caused by a ring of matter surrounding the earth, and not the sun.

Professor Wright, of Yale University, has determined that the spectrum of the light is continuous, and therefore is essentially reflected sunlight. He has also determined that the light is partially polarized in a plane passing through the sun, and that the amount of the polarization is between 15 and 20 per cent. The origin of the minute particles which reflect the light has been accounted for in many ways. By some they are believed to have been thrown out from the corona of the sun; by others to be composed of dust thrown out from the equatorial

regions of the sun; but by most they are believed to be an immense cloud of meteoroids filling the space between the earth and the sun. The meteoric theory of the sun's heat presupposes a multitude of these meteoric bodies constantly falling into the sun to supply the loss by radiation, as well as multitudes of others which never reach the surface. It is not propable, however, that these meteors if they exist play any part in the phenomena of the zodiacal light.

A most valuable and important contribution to our knowledge of the zodiacal light is due to a recent research of Seeliger. It has long been known that the slow, secular changes of some of the elements of the orbits of the planets of the solar system, when these are derived from observation, are not in exact agreement when these same changes are determined from a computation based upon the law of universal gravitation. In particular, it is found that the computed motions of the perihelia of the orbits of Mercury and Mars and of the node of Venus differ from the motions derived from observation by amounts far in excess of the uncertainties inherent in the observations themselves. Many attempts to account for the first discrepancy have been made. Thus, Leverrier assumed that it arose from the disturbing pull of a small planet near the sun, which for many years found its place in our astronomical books under the name of Vulcan. Other astronomers have supposed that the disturbance might be due to the pull of a ring of particles about the sun, to an unequal distribution of the material within the body of the sun itself, or even to an inexactness in the accepted statement of the law of gravity. Analysis shows, however, that none of these explanations are admissible, for all of them lead to disturbances in other directions, either of the planets or of the moon, which are in discordance with observation. But Seeliger has shown that if there be ascribed to the zodiacal light an even almost inconceivable tenuity, its gravitational pull will exactly account for the discrepancies observed, without at the same time introducing any new discrepancies. The densities to be assumed for the inner and outer portions of the zodiacal light in order that its attraction may be sufficient to balance the former discrepancies are as follows:

Average density of the inner portion, extending from the sun to 0.24×, the distance of the earth $= 2.52 \times 10^{-11} \times$, the sun's density;

Average density of the outer portion, extending from the sun to 1.20×, the distance of the earth $= 2.52 \times 10^{-11} \times$, the sun's density. Average density of the outer portion, extending from the sun to 1.20 ×, the distance of the earth $= 0.0026 \times 10^{-11} \times$, the sun's density.

ZOË, zō'ē (Gr. Ζωή), empress of the East: b. about 978; d. 1050. She was the daughter of Constantine VIII, and became the wife of Romanus III in 1028. In 1034 Romanus was put to death by Zoe and Michael the Paphlagonian, whom she married and raised to the throne as Michael IV. The latter dying, was succeeded by his nephew, Michael V, who was deposed by the people in 1042. Zoë and her sister Theodora were then proclaimed joint sovereigns. She displayed great ability and firmness in the government, and in 1042 married Constantine IX, Monomachus, who supplanted Theodora. She reigned till her death.

ZOETROPE, an optical instrument used as a mechanical top, depending, for its interest, on the constancy of visual impressions. It consists of a rotating drum, open at the top, in which around its inner periphery are placed strips of paper, having figures of men, animals, etc., in varying positions. By turning the cylinder the images are seen through slots in its upper side, giving the effect of action to the figures.

ZOFFANY, tsŏf'fā-nĭ (properly **ZAUFELBY**), **Johann**, British painter: b. Ratisbon, 1733; d. London, 11 Nov. 1810. He was a pupil of Speer at Ratisbon, but at 13 ran away to Italy, where he studied for 12 years. In 1758 he went to England, where he first attracted attention by a portrait of Garrick, and soon won considerable reputation, becoming one of the original members of the Royal Academy on its foundation in 1769. He was sent by George III to Italy, where he remained in 1772–79, and among other paintings executed 'The Tribune of Florence,' one of his most celebrated works. In 1783–90 he engaged in painting in India; and the last 20 years of his life he spent in England. Among his further paintings are 'Earl of Barrymore'; 'Foote'; 'Weston'; 'Members of the Royal Academy'; 'Tiger Hunt'; and 'Embassy of Hyder Beg.'

ZOGBAUM, Rufus Fairchild, American artist: b. Charleston, S. C., 28 Aug. 1849. He studied at the Art Students' League 1878–79 and in Paris with Léon Bonnat in 1880–82, made extensive study of European armies in field and garrison, and later became known as a leading delineator of military and naval subjects, which he renders with scrupulous fidelity to the various points of detail. His publications, written and illustrated by himself, are 'Horse, Foot and Dragoons' (1887); 'All Hands' (1897); 'Ships and Sailors' and 'The Junior Officer of the Watch' (1908).

ZOHAR, zō'här, the Bible of the Kabbalists, long reverenced by Jewish mystics and regarded by some as higher than the Bible and the Talmud, but proved a clever forgery. The secret science of the Kabbala received a marked development at the beginning of the 13th century, when a mystic, Ezra or Azriel (b. 1160; d. 1238), compiled a work called 'Brilliancy' (*'Bahir'*). In an atmosphere of reputed miracles and a new Messiah, there appeared some years later the most famous Kabbalistic book of the time — the 'Zohar,' or 'Splendor.' It was offered as the work of Simon ben Jochai, a sage of the 2d century, of whom many legends are told. He is said to have spent years in solitude, a hermit receiving special revelations. It was claimed that for over a thousand years the 'Zohar' had been concealed in a cave in Galilee and had been at last brought to light. The literary forger who "discovered" the 'Zohar' was Moses of Leon (b. Leon, about 1250; d. Arevalo, 1305), who employed an Aramaic idiom to give the book an air of antiquity, and with such skill that Jew and Christian alike were deceived and some even to-day attribute to it hoary age. Yet his widow declared that it was a forgery.

The character of the 'Zohar' can hardly

'La Faute de l'Abbé Mouret' (1875), whose subject is clerical celibacy; 'Son Excellence Eugène Rougon' (1876); 'L'Assommoir' (1877), a powerful but revolting study of the effects of drunkenness and idleness, the first great success of the series; 'Une page d'amour' (1878); 'Nana' (1880), a coarse picture of courtesan life; 'Pot-Bouille' (1882); 'Au Bonheur des Dames' (1883), dealing with the great shops of Paris; 'La Joie de Vivre' (1883); 'Germinal' (1885), treating of the life of French miners; 'L'Œuvre' (1886), in which he dissects literary and artistic decadents; 'La Terre' (1888), a study of the French peasantry in which prurient naturalism reaches the zenith of repulsiveness; 'Le Rêve' (1888); 'La Bête Humaine' (1890), treating of railways; 'L'Argent' (1891), dealing with stockbrokers and company promoters; 'La Débâcle' (1892), a powerfully realistic picture of military life in connection with the Franco-German war and the break-up of the Second Empire; and 'Le Docteur Pascal' (1893), in which the whole is brought to a conclusion. Immediately after completing this huge undertaking he started the 'Trois Villes' series, consisting of 'Lourdes' (1894), 'Rome' (1896), and 'Paris' (1898), in which he portrays the spiritual development of a priest, Pierre Froment, out of miraculous Christianity through a sort of social Catholicism into a creed of justice and labor. In the incomplete tetralogy entitled 'Les Quatres Evangiles' ('The Four Gospels') he proposed to formulate his social gospel. The first volume is 'Fécondité (1900), whose hero, Mathieu, is the son of the hero of the preceding series. The second volume, 'Travail' ('Labor,' 1901), has a hero named Luc; and of the remaining two, 'Vérité (Truth) and 'Justice,' whose heroes were to be named after the other two evangelists, the former was appearing at the time of his death. In the eyes of English readers Zola appears best in his short stories, of which, in addition to those already mentioned, collections entitled 'Le Capitaine Burle' (1882), and 'Naïs Micoulin' (1883) have been published. His famous story of 'L'Attaque du Moulin' forms part of the volume of 'Soirées de Médan' (1880), to which Maupassant and other friends also contributed. He defended his view of the nature and function of literary art and collected many critical articles in several works. Several of his novels were dramatized by himself and others, and he also wrote for the stage 'Les Héritiers Rabourdin' (1874), and 'Le Bouton de Rose' (1878), but none of them, except 'L'Assommoir' (1881), known in Charles Reade's English version as 'Drink' (1879), were at all successful. On 13 Jan. 1898, Zola, convinced of the innocence of Captain Dreyfus, (q.v.) went chivalrously to the defense of that officer in a letter 'J'Accuse' published in *L'Aurore*. In it he arraigned the government for the irregularities of Dreyfus's trial, making charges that practically forced the government to prosecute him, an expedient that achieved its purpose in reopening the Dreyfus case and led to the complete vindication of that officer. Zola was tried in February 1898 and a verdict imposing imprisonment and fine was brought against him. He appealed the case and the verdict was quashed by the Cour de Cassation, 2 April 1898. A second trial was called and Zola, his purpose accomplished, decided not to appear, but went to England where he remained until the amnesty for offenders connected with the Dreyfus case, 24 Dec. 1900, permitted his return to France. His account of his connection with the case is given in 'L'affaire Dreyfus. La veritie en marche' (1901). He was created a knight of the Legion of Honor in 1888 and an officer in 1893, but after his condemnation in 1898 his name was removed from the roll. He was president of the Société des Gens de Lettres in 1891–94, but he was repeatedly refused admission to the Academy. Zola was the recognized head of the naturalistic school in fiction, but his followers were latterly few in number. His novels belong rather to the domain of science than to that of art. They are studies, in the main faithful enough though not free from distortion and exaggeration, in moral and social pathology; but they are not true to life and nature in the fullest sense, in the only sense which would entitle them to rank as artistic creations. Translations of the most important have appeared, chiefly by Vizetelly. Consult Brunetière, 'Le Roman Naturaliste' (1883); R. H. Sherard's highly eulogistic biographical and critical study (1893); 'La Procès Zola' (2 vols., 1898; Eng. trans. 1898); Vizetelly, E. A., 'Emile Zola, Novelist and Reformer' (1904); and his 'Letters' (1908).

ZOLLARS, Ely Vaughan, American educator: b. near Lower Salem, Washington County, Ohio, 19 Sept. 1847; d. Warren, Ohio, 10 Feb. 1916. Graduated from Bethany College, West Virginia, in 1875, he was pastor of the church of the Disciples of Christ at Springfield, Ill., in 1885–88, and in 1888–1902 was president of Hiram College (Ohio). He was president of the Texas Christian Union in 1902–06; and from 1906 was president of Phillips University. His writings include 'Holy Book and Sacred Day' (1893); 'Bible Geography' (1894); 'Great Salvation' (1895); 'Hebrew Prophecy'; 'The King of Kings'; 'Word of Truth'; 'The Commission Executed'; 'Sermons,' etc.

ZOLLICOFFER, zŏl'ĭ-kŏf-ẽr, **Felix Kirk,** American soldier: b. Maury County, Tenn., 19 May 1812; d. near Mill Springs, Ky., 19 Jan. 1862. He entered the printer's trade, published a weekly newspaper at Paris, Tenn., for about a year, and afterward was editor of the *Observer* at Columbia, Tenn., his duties being temporarily interrupted by his service in the Seminole war, in which he rose to be a commissioned officer. At Columbia he also published and edited an agricultural weekly. He became editor of the Nashville *Banner*, the leading Whig organ of Tennessee, in 1841; in 1844–49 was State comptroller; and in 1853–59 was a representative in Congress. In 1861 he entered the Confederate army with brigadier's rank. He was in immediate command at the battle of Mill Springs, on the Cumberland, when Thomas drove the Confederates from the field, and achieved the first real victory for the National cause. Zollicoffer was killed within the Union lines, whither he had passed by mistake while on a tour of reconnaissance.

ZÖLLNER, tsĕl'nẽr, **Johann Karl Friedrich,** German physicist and astronomer: b. Berlin, 8 Nov. 1834; d. Leipzig, 25 April 1882. Educated at Berlin and Basel, he became a

lecturer in the University of Leipzig in 1865, in 1866 professor extraordinary of physical astronomy, and in 1872 professor ordinary. He made numerous contributions to astronomical science. These included the determination of the reflective capacity (albedo) of many planets and a study of their thermal conditions; photometric investigations of the Mercurian phases; and a study, through observation, of the intensity of solar radiations at their source, of the solar temperature. His 'Grundzüge einer allegemeinen Photometrie des Himmels' (1861) contained the description of a new instrument, the astrophotometer, for the measurement of the light and color of stars. To the publications of the Royal Saxon Scientific Society he furnished many papers on the physical constitution of the sun and stars; and he constructed spectroscopic instruments. 'Ueber die Natur der Kometen' (1872; 3d ed. 1883) expounded the theory that the brightness of comets is due not to the fact that they are incandescent through heat but that they are glowing with electricity. Zöllner was latterly interested in spiritualism. Among his further volumes are 'Photometrische Untersuchungen' (1865), and 'Ueber die universelle Bedeutung der mechanischen Principien' (1867). 'Wissenschaftliche Abhandlungen' (4 vols., 1878–82). Consult the study by F. Körber (Berlin 1899), and Clerke, A. M., History of Astronomy in the 19th Century' (London 1908).

ZOLLVEREIN, tsŏl'fĕr-ĭn ("customs-union"). The feeble German Confederation formed in 1815 failed in many respects to meet the desire for union among the German people, or even to satisfy their practical requirements. The trade of Germany in particular suffered much from the obstructions caused by the different customs systems of so many petty states. In 1818 Prussia took the initiative of abolishing internal customs, but this policy excited much opposition among the other German states, and even on the part of the Bund itself, which was indeed to some extent justified by the coercive measures used by Prussia to enforce the adoption of its policy on the smaller German states within its bounds. Prussia offered to admit the other German states within its union, but many of them preferred to set up rival and antagonistic associations. Thus Bavaria and Wurtemberg formed a customs league in 1827, and Hohenzollern joined these states in 1828. In the same year was formed the Middle German Union, including Saxony, Hanover, Hesse, Brunswick, Nassau, Oldenburg, Bremen, Frankfort-on-the-Main, etc., and in 1834 another union (Steuerverein) between Hanover, Brunswick, Schaumburg-Lippe, and which was joined by Oldenburg in 1836. But these hostile unions were not sufficiently extensive to have any great vitality, and they were gradually distintegrated by the desertion of their individual members to join the Prussian union. Electoral Hesse joined in 1831; Bavaria, Wurttemberg, Saxony, and other states in 1833; Hesse-Homburg, Baden, and Nassau in 1835; Frankfort in 1836; Luxemburg in 1842; Hanover, Oldenburg, etc., in 1851. During the treaty period of 1854–65 nearly all Germany, with the exception of Austria, the two Mecklenburgs and the Hansetowns, was included in the union. A difference of views between the various parties to the union began at this time to develop, which caused much tedious negotiation. In general the north of Germany was in favor of imposing import duties on foreign trade for purposes of revenue only, while the south favored protective duties. As each member of the Zollverein had an equal voice in the direction of a common policy it was impossible to adjust these differences so as to satisfy the more powerful states, particularly Prussia. Austria also wished either to be included in the union or to break it up. Matters continued substantially in the same state after the renewal of the treaty from 1 Jan. 1866 to 31 Dec. 1867; but the war of 1866 put an end to this agreement and new arrangements were entered into according to the political combinations then formed, Prussia obtaining a preponderating influence in the union of 1867, which included the North German Bund, Bavaria, Würtemberg, Baden, Hesse (south of the Main) and Luxemburg. It was directed by a Zollbundesrath and a Zoll Parliament. The total number of votes in the Zollbundesrath was 58, of which Prussia had 17. This arrangement, formed for 12 years, was also brought to an end prematurely by the formation of the German Empire. By article 33 of the constitution of the empire the territory included in the Zollverein is to coincide with the territories of the empire, with a few exceptions noticed below. The powers of the Zollbundesrath and Zoll Parliament are transferred to the legislative bodies of the empire, and the affairs of the central bureau of the Zollverein are transferred to committees formed by the Federal Council of the empire. The territories of the free ports of Hamburg and Bremen were for some time excluded from the Zollverein and some communes of the grand duchy of Baden and a fragment of Hamburg were still excluded from it; while Luxemburg and the Austrian commune of Jungholz were included in it up to the fall of the empire in November 1918. Consult Ashley, W. L., 'Modern Tariff History: Germany, United States, France' (2d ed., London 1910); 'Cambridge Modern History' (Vols. X, XI, New York 1909); Dittmar, 'Der deutsche Zollverein' (Leipzig 1867); Worms, 'L'Allemagne économique au histoire du Zollverein allemand' (Paris 1874). See GERMANY; WAR, EUROPEAN.

ZOLNAY, George Julian, American sculptor: b. Pecs, Hungary, 4 July 1863. Although educated for the diplomatic service, he eventually entered the Royal Art Academy of Bucharest and later the Imperial Academy of Fine Arts of Vienna, graduating with highest honors from both institutions. In 1894, after his work at the Columbian Exposition of Chicago, he settled in New York City where he won national reputation through his Tympanum and Poe bust for the University of Virginia; the Winnie Davis Memorial (Richmond, Va.); decorative figures for the Nashville Centennial; the monuments to General Bartow and McLaws (Savannah, Ga.); the Soldier Monument for Owensboro, Ky.; the Duncan Jacob Memorial for Louisville, Ky., and a large number of portrait busts.

In 1903 he was appointed director of the sculpture exhibit at the World's Fair in Saint Louis and professor of sculpture and perspective at Washington University. He resigned in 1909 to become director of the new University City

Art Academy. There he produced the heroic size granite group for the United States Custom House in San Francisco; the Sam Davis and Soldier Monument for Nashville, Tenn.; the Hayes Memorial for Richmond, Va.; two colossal lions for University City; the Laclede Monument for Saint Louis; portrait busts of Emperor Francis Joseph, Victor Hugo, Gen. Stonewall Jackson, Major Rollins, Clara Hoffman, Walter Sheldon and others. In 1913 he transferred his studio to Washington, D. C., where he has since produced the Saint Louis Confederate Monument; the great Industrial Monument for New Bedford, Mass.; a large educational frieze for the National Capitol's new high school; the Hoxie Memorial for Arlington cemetery; a number of portrait busts, and the Dr. Still Monument for Kirksville, Mo. He was president of the Saint Louis Artist's Guild, Vice-president Society of Washington Artists, Union Internationale des Arts et Sciences of Paris. He has won four bronze, one silver and three gold medals and was decorated by the king of Rumania with the Order Pour le Merit of the first class.

ZOMBOR, zŏm'bŏr, or **SOMBOR,** Hungary, a town of the comitat of Bács-Bodrog, on the Baczer or Franzens Canal, which unites the Theiss with the Danube, 65 miles southwest of Szegedin. It has two Greek churches, a magnificent town-house, and a public library, and carries on manufactures of silk. There is a large trade in cattle and corn. Pop. 30,552.

ZONA LIBRE, sō'nā lē'brā, formerly the designation of a strip of country extending along the whole northern frontier of Mexico, 20 kilometres wide, where imported goods were admitted at 10 per cent of the ordinary duties for use within the zone. This zone was first established on the frontier of the state of Tamaulipas alone, in 1858, and was not extended across the whole frontier until 1885. At one time after the Civil War, the United States authorities claimed that the privileges permittted within the zone encouraged smuggling; the Mexican government claimed that the conditions of retail trade made the zone a necessity; opposition to the zone, however, continued among competing manufacturers in the interior of Mexico and the zone privileges were at length eliminated.

ZONARAS, Joannes, Byzantine historian of the first half of the 12th century A.D. He filled some distinguished offices about the imperial court, but gave himself up to a religious life as a monk of Saint Basil, employing his leisure hours in the compilation of a 'History of the World from the Earliest Periods to the Year 1118.' In this work (of which an edition appeared at Paris in 1686) he follows principally the narrative of Dio Cassius, of whose first 20 books nothing is extant save Zonaras' abstract; but as he approaches his own times he becomes more entitled to attention, as his mistakes arise evidently more from ignorance than design. There is also extant a commentary on the apostolic canons by him. There is an edition of the 'History' by Pinder (1841–44), with a third volume by Büttner-Wobst (1897). His 'Chronicon' was edited by Dindorf (Leipzig 1868–75). Consult Krumbacher, Karl, 'Geschichte der byzantinischen Litteratur' (2d ed., Munich 1897).

ZONE, the term applied to any portion of the earth's surface bounded by two parallels of latitude, but more particularly applied to five such zones, the position of which is marked by natural boundaries. These five zones are called the torrid, northern and southern temperate, and northern and southern frigid zones. The torrid zone extends 23½° north and south of the equator; and twice a year the sun shines vertically on its inhabitants. This zone is bounded, on both sides of the equator, by the two tropics; that is, the circles in which the sun reaches its greatest distance from the equator. As the rays of the sun here are nearly vertical a perpetual summer reigns, and day and night under the equator are always equal; and even at the tropics the difference is scarcely an hour. Owing to the nature and situation, however, of the countries in this zone the heat is not everywhere the same. The warmest portions are the sandy deserts of Africa; in the regions nearer the equator where vegetation prevails the heat is less excessive; in the islands of the South Seas a milder climate prevails, and the highest mountains of Peru and equatorial Africa are covered with perpetual snow. The two temperate zones extend from the tropics to the polar circles. They contain the most populous countries, and the climate is various. As the distance from the tropics increases the heat under similar conditions diminishes, the difference of the seasons becomes greater, the days and nights become more unequal until we arrive at a point where once a year the sun does not appear above the horizon during the 24 hours, and once a year does not set for the same time. The circles passing through these points, parallel to the equator and the tropics, form the limits of the temperate zones, and are called the arctic and antarctic circles. The distance from the tropics to the polar circles, or the breadth of the temperate zones, both in the northern and southern hemispheres, is 43°. All beyond the polar circles to the poles is called the frigid zones. The distance from the polar circles to the poles is 23½°. The characteristic of the frigid zones is, that day and night are more and more unequal the nearer you approach the poles, and for days, weeks and even months the sun is either constantly above or constantly below the horizon. At the poles the year consists of one day and one night each six months long.

ZONE OF FLOWAGE. See ROCK-FLOWAGE.

ZONE OF FRACTURE. See ROCK-FLOWAGE.

ZOOGEOGRAPHY, the science of mapping out the surface of the earth with reference to its faunæ; the study of the distribution of animal life. It has always been obvious to travelers, and even the most superficial students of nature, that the various regions of the earth's surface were characterized, among other differences, by local peculiarities in animals and plants. It is a commonplace of knowledge that the animal life of the tropics is different from that of the arctic regions; that the birds and mammals and small creatures of Africa differ

almost altogether from those of South America or Australia. Closer examination shows that such differences exist in a greater or less degree between lesser regions, as the east and west sides of a continent, groups of islands separated by a sea-space, and so forth. On the other hand, there may be found striking resemblances in the faunæ of certain separate regions, or a sameness over an extensive area, as Europe and Asia.

The importance and significance of these facts impressed themselves upon scientific men only within recent times. As long as it was held that each species must have been created, as a general rule within the geographical area which it now occupies, the most curious facts of distribution could be regarded only with "sterile wonder." But when the idea came to be entertained that allied species have had a common origin, it was obviously implied that they or their ancestors must have had a common birthplace, and consequently, when we find members of a group severed from their nearest kindred, we feel bound to inquire how this came about. Thus, we have to explain how the tapirs are confined to the Malayan region and South America; the camels to the deserts of Asia and the Andes; marsupials to the Australian region and America; how the birds, mammals and reptiles of North America resemble those of Europe more than those of South America and so on.

Means of Dispersal.—Accepting as a starting point the proposition that the various forms of life originated in some parent-stock or stocks at a particular place or places, the present distribution of their descendants as we know them, must depend mainly upon the powers of dispersion which each possessed, and the character of the physical influences and obstructions which acted as controlling factors or barriers in guiding their dispersal along certain lines and altogether prevented it elsewhere. Theoretically a new stock would spread equally in all directions from its point of origin; actually a very irregular and complicated kind of distribution has ensued in most or all cases. Hence an inquiry as to the means and limitations of dispersion possessed by animals and plants is of first importance.

It is scarcely necessary to draw attention to the facilities for diffusion possessed by animals endowed with great locomotive powers, and especially among land animals, by those having the power of flight (q.v.); but it is important to note that some animals, which in the adult state have only feeble powers of locomotion, are better endowed in this respect when young. Such, for example, is the case with echinoderms, marine mollusks and similar lowly aquatic forms, all of which develop from free-swimming and often far-drifting larvæ. (See DEEP-SEA LIFE). But accidental modes of dispersal must also be taken into account. The carrying power of winds is known to be sufficient to bear along in the air fine dust across seas many hundreds of miles in width, and we have in that agency alone an adequate means of accounting for the dispersion of all plants propagated by minute spores. For that reason the distribution of most cryptogamic plants hardly enters into the problem, since these mosses, fungi, seaweeds and the like are almost universal. What part winds may have played in carrying the seeds of flowering plants is more doubtful; but observations show that even for such seeds, especially when provided with some kind of feathery appendage, winds may occasionally serve as a means of transport for very long distances. See PLANT GEOGRAPHY; PLANTS, MIGRATION OF.

But in the case of animals also, winds are a more important means of transport than one might at first suppose. Birds and insects are often blown immense distances out of their course; and to this cause, for instance, is due the arrival every year of American birds on the coasts of Great Britain and France, while European birds almost never reach America—a fact plainly due to the prevalent easterly direction of the winds, and especially the gales in spring and autumn, when birds are migrating. Insects have been caught on ships more than 300 miles from land. Further, there are well-authenticated cases of even crabs, frogs and fishes being carried long distances by storms, and in this way it is possible to account for the transference of fish, etc., from one river system to another. Still more frequently, in all probability, are the eggs of such creatures transported by this means.

Next, marine currents also form, beyond doubt, a highly important means of dispersal both for plants and animals, and that in various ways. First, seeds may float on the surface of the ocean, and be carried by currents hundreds of miles, and become stranded on a distant shore still in a condition fit for germination. The experiments of Darwin to determine the vitality of seeds in sea-water first enabled us to appreciate the importance of this factor. Further, marine currents often carry on their surface various kinds of natural rafts, which may transport both plants and animals. In the polar regions icebergs and icefloes may serve this purpose; and elsewhere trunks of trees, and even fragments torn from the land. Such fragments, forming small islands with erect trees upon them, have been seen at a distance of 100 miles from the mouth of the Ganges and other rivers. Wallace points out that ocean waifs of one kind or another are almost the only means we can imagine by which land-shells can have acquired the wide distribution for which they are remarkable. Again, locomotive animals are very frequently the means of dispersing both plants and other animals. Seeds may be attached to the fleece or fur of mammals or the plumage of birds, or may be enclosed in clumps of earth clinging to the feet or some other part of bird or beast, even of insects. It seems probable that aquatic birds and water-beetles have been the means of distributing aquatic plants and freshwater mollusks, which are remarkable for their wide diffusion; and the spawn of amphibians and fresh-water fishes may be conveyed from one body of fresh water to another by the same means.

Lastly, man is often unintentionally the means of conveying both plants and animals from one region to another. The foreign plants found growing on ballast heaps near every civilized port are instances of this, and so, also, are the plants which have sprung from seeds introduced with imported grain and

merchandise. The whole costal region of North America is overrun with European weeds. Whereever European ships have gone the rats and other vermin of the Old World have accompanied them, and hundreds of species of exotic injurious insects are known in all agricultural districts.

Obstacles to Diffusion of Animals.— For all land plants and land animals the most obvious and effective barrier is a wide expanse of ocean; and where the expanse is very wide it is seldom passable except with the aid of man. For land mammals the ocean is an absolutely impassable barrier, and hence native mammals are always absent from oceanic islands (that is, islands that have never been connected with the mainland); and this barrier is almost equally effective for serpents and amphibians, which also are nearly always wanting where there are no native mammals. Lizards are more frequently found indigenous on oceanic islands, though their means of transit from the mainland is unknown. Arms of the sea and broad rivers are likewise generally impassable for the creatures mentioned, though some of them have greater powers of swimming than is generally supposed. The tiger, the jaguar, the bear and the bison are capable of swimming the widest rivers; pigs have been known to swim ashore when carried out to sea to a distance of several miles; and even a boa constrictor, it is said, has swum to the island of Saint Vincent from the South American coast — a distance of 200 miles.

Mountains, and especially high mountains, are also frequently effective barriers to the migration of land plants and animals; but in some cases they enable plants and animals of a cold climate to spread along their summits into latitudes where, in the plains, the climate is too hot for them. Again, deserts act as a barrier to the majority of plants and animals; forests are a barrier to the camel, hare, zebra, giraffe, etc.; treeless regions to apes, lemurs and many monkeys; plains to wild goats and sheep. Broad rivers also act occasionally as barriers to distribution, and that, strange to say, even in the case of some species of birds.

Another important barrier is that of climate; but climate merely limits the range of a species or group within a continuous area, for example, through limiting the food supply by restricting vegetation. The range of insects is peculiarly liable to be limited in this way, certain insects being attached to particular species of plants, or at least to genera or families; and for this reason insects, in spite of the exceptional facilities for dispersal which many of them enjoy, are remarkable, as a rule, rather for the restriction of their areas of distribution than for their wide diffusion. Various other minor factors might be mentioned.

But a more generally operative organic barrier consists in the fact of a region being already fully occupied by a native flora and fauna, so that there is no room for newcomers. Hence it happens that seeds may be wafted in plenty from one country to another without a single plant growing from these seeds being able to establish itself; and there may even be, as in South America, a free communication with another region while the fauna remains strikingly distinct, simply because that portion of the American continent is already completely stocked with a fauna perfectly adapted to the physical conditions there prevailing.

The barriers to the spread of marine creatures are not so numerous as in the case of terrestrial forms. The freedom of communication between one part of the ocean and another makes it impossible to mark out any marine zoogeographical regions, though many seas and coasts are distinguished by characteristic fishes and other marine creatures. There is also in the ocean a vertical distribution, the limits of which are determined by depth and its conditions. The principal barriers for fish are temperature and the intervention of land. Thus, the Isthmus of Panama is at present a complete barrier for fishes requiring warm seas.

Geological Evidence.— If all the barriers to migration had existed in all past time as they are now, it would be quite impossible to explain the present distribution of plants and animals on the supposition that kindred groups have had a common birthplace. But the solution of the problems of distribution is to be found in the fact that all the barriers are liable to change. Of changes of sea and land geology supplies us with abundant evidence. Portions of the mainland now continuous were at one time severed by arms of the sea; and islands have been formed by the severance of portions of land that once belonged to the mainland. Such islands are known as continental islands, and the study of their faunæ and floras is one of peculiar interest in connection with geographical distribution. These faunæ and floras show, as might be expected, a greater or less degree of correspondence with those of the mainland from which the islands have been cut off; and the resemblance is the closer the more recently the land connection has been destroyed. The relative date of the disunion is usually approximately indicated by the depth of the sea which now separates island and mainland, shallow seas dividing portions of land that have only recently been disconnected, and deeper seas separating those which have been longer apart.

The most remarkable case of isolation is presented by the Australian region, the fauna and flora of which are the most peculiar in the world. In the widest sense, this region includes not only the vast island of Australia itself, but also New Guinea and all the Malayan and Pacific islands to the east of a deep channel between the islands of Bali and Lombok — a channel the significance of which, as a boundary line for plants and animals, was first pointed out by A. R. Wallace, the great authority on animal distribution, and hence known as Wallace's Line. The great feature of this region (so far as animal distribution is concerned) is "the almost total absence of all the forms of mammalia which abound in the rest of the world, their place being taken by a great variety of marsupials." This presents one of the best examples of what are known as discontinuous areas of distribution, and offers an illustration of the mode in which such discontinuity is usually brought about. The early severance of the Australian region from the Asiatic continent (in the Mesozoic

characteristic life of the different regions, for which the reader must be referred to the works cited at the end of the article.

(1) Palæarctic Region, including Europe and north temperate Asia and Africa to the northern borders of the Sahara.

(2) Ethiopian or Palæotropical Region, consisting of all tropical and South Africa, together with Madagascar and the Mascarene Islands.

(3) Oriental Region, comprising all Asia south of the Palæarctic limits, and the Malay Islands as far as the Philippines, Borneo and Java.

(4) Australian Region, the Papuan Islands, Australia, New Zealand, and the islands of Oceanica. Celebes might be referred almost with equal right to this or the previous region. New Zealand is treated by Wallace as a highly peculiar sub-region of this great region.

(5) Nearctic Region, comprising all temperate and arctic North America, including Greenland, and extending on the south to an irregular line running from the Rio Grande del Norte on the east to a point nearly opposite Cape Saint Lucas on the west.

(6) Neotropical Region, the American continent south of this line, together with the West Indian Islands, sometimes called Neogæa.

Heilprin and others advocate the union of the Nearctic and Palæartic regions under the name of Holarctic, and introduce three transitional tracts (the Mediterranean, embracing southern Europe, northern Africa and western Asia, south of the Caspian and west of India, but exclusive of the southern half of Arabia; the Sonoran tract, embracing the northwest of Mexico; and the Austro-Malaysian tract, embracing Celebes and the smaller islands lying between it and New Guinea and Australia). Otherwise his major faunal divisions of the globe are similar to those of Wallace.

On plant distribution the most important recent works are those of Engler and Drude. Engler attempts to trace the history of the vegetable kingdom since the Tertiary period, and comes to the conclusion that already in the Tertiary period four "floral elements" (*Florenelemente*) could be distinguished, namely:

(1) The Arcto-tertiary element, characterized by an abundance of conifers and numerous genera of trees and shrubs now prevalent in North America, or in extratropical eastern Asia and in Europe.

(2) The Palæotropical element, characterized by the presence of the families and subfamilies dominant in the tropics of the Old World; and still more by the absence of certain families, groups and genera found in the territory of the Arcto-tertiary element.

(3) The Neotropical or South American element, which, according to Engler, must have had in Tertiary times much the same character as that now possessed by tropical Brazil and the West Indies.

(4) The old Oceanic element, consisting of forms which possessed the power of traversing considerable stretches of ocean and developing further on islands.

The modern provinces of the vegetable kingdom are subordinated by Engler to these great divisions. Drude, in the first place, distinguishes the oceanic (marine) flora from the terrestrial forms, and the latter he divides into three great groups, and these again into 14 floral domains. See PLANT GEOGRAPHY.

Bibliography.— Sclater, 'Geographical Distribution of Birds,' in 'Journ. Linn. Soc.' (Zool.), Vol. II (1875); Wallace, 'Geographical Distribution of Animals' (New York 1876); Wallace, 'Island Life' (New York 1885); Heilprin, 'Geographical and Geological Distribution of Animals' (New York 1887); Beddard, 'Text-book of Zoogeography' (London 1895); Engler, 'Entwicklungsgeschichte der Pflanzenwelt' (Leipzig 1879–82); Drude, 'Die Florenreiche der Erde' in 'Petermann's Mitteilungen' (1884).

ERNEST INGERSOLL.

ZOOLATRY, the worship of animals. This seems to have passed through three stages: (1) The animal was reverenceed and propitiated as possessing a power greater than that of man. (2) It was regarded as an incarnation of some deity or spirit. (3) It was raised to the position of a tribal ancestor. Zoölatry had its origin in the belief of primitive man that all nature was endowed with life and that many beings were possessed of great and magical powers. Animals were believed to be especially endowed with such powers. They were also thought to have their chiefs and tribal organizations just as man had, and their great magicians who were powerful enough to bring confusion upon their enemies. Hence primitive man attempted to conciliate all the mysterious forces and powers of nature, among them, those of the animal kingdom. Out of this, through successive stages, grew animal worship, with all its attendant ceremonies, forms and incantations. In the early history of the human race zoölatry of some kind was very prevalent. Traces of it appear in the Bible, as in the story of the Golden Calf made by the Israelites (Ex. xxxii). Zoölatry took deep root in the religious life of the ancient Egyptians, and all three forms flourished among that people. Juvenal opens his 15th satire with a scathing invective of Egyptian zoölatry, and detailed accounts of it occur in Herodotus, Plutarch, Strabo and Cicero. In the present day zoölatry survives chiefly in India and among the snake-worshippers of the west coast of Africa. See NATURE WORSHIP.

ZOOLOGICAL GARDENS, or **PARKS,** places for the keeping and attractive display of living animals, where they may live, as far as possible, in the open air and under natural conditions; a zoological garden thus differs from a menagerie, as that term is now understood, in that in the latter the animals are confined in narrow prison-cages, under cover, and are usually borne from place to place to be displayed for a fee. Collections of captive animals have always been kept by royal and eminent persons, and formed a large element in the sights and amusements of the populace in ancient and mediæval cities. The present conception of zoological collection, as a place where animals shall be maintained in the greatest practicable freedom for the sake of exhibiting their traits to the student, and shall be regarded only secondarily as objects of curiosity, is a modern idea, and one that has been

evidence that the study of zoology was prosecuted to any considerable extent before the time of Aristotle. In his hands it became at once a science, and the foundations of a system of classification were laid. No artificial system of classification has ever been proposed in zoology, like the sexual system of Linnæus in botany; but from the very first to the present day, a natural grouping of animals has always been attempted. To this the widely-marked distinctions between the principal groups almost unavoidably led. Aristotle brought to bear on the subject the highest powers both of observation and of generalization, and some of the groups established by him retain their place in the most modern systems.

Aelian and Pliny show no capacity for the scientific treatment of the subject, and in their writings facts are largely mingled with fables. During the Middle Ages the greatest name in connection with the history of the science is that of Albertus Magnus; much of whose knowledge, however, was derived from Aristotle and other ancient authors. From his time, in the first half of the 13th century, to the beginning of the 16th, zoology made little advances; but the new activity of mind which then displayed itself soon sought this as well as other directions, and an especial impulse was given to zoology by the progress of geographical discovery. The names of Belon and Rondelet are the two greatest in this department at this period, and by them zoology was enriched with many new facts, while attempts were made at a more perfect classification. Aldrovandi and Gesner soon followed, besides others who began to direct their attention more specially to particular branches of zoology; but it was not till after the middle of the 17th century that any real progress was made in classification founded on a philosophical study and comparison of animals. The works of Ray are described by Cuvier as "the foundation of modern zoology." The materials, however, were in great part prepared, and the first outline of a system sketched by Willughby. From the days of Aristotle, zoology had never been prosecuted with such acuteness of observation, accuracy of description and breadth of philosophical generalization as it was by Willughby and Ray. The progress of the science now became very rapid. Buffon won for it, by his interesting descriptions and brilliant style, the general attention of the educated portion of society in his own and in other countries. He was almost immediately followed by Linnæus, who, extending his studies from botany to zoology, not only enlarged the science by his own observations and discoveries, but rendered it far greater service by gathering together the facts ascertained by others, and by the improvement which he effected in classification. Some of the larger groups established by Linnæus have been retained by all subsequent naturalists without essential modification of their characters, and even his smallest groups — genera — have been very generally retained, though now regarded as constituting tribes or families. According to the Linnæan system, the animal kingdom is divided into six great classes, further brought together in groups of two each. His classes are I. *Mammalia*, with the orders Primates, Bruta, Feræ, Glires, Pecora, Bellua and Lete; II. *Aves*, with the orders Accipitres, Picæ, Anseres, Grallæ, Gallinæ and Passeres; III. *Amphibia*, with the orders Reptilia, Serpentes and Nantes; IV. *Pisces*, with the orders Apodes, Jugulares, Thoracici and Abdominales; V. *Insecta*, with the orders Coleoptera, Hemiptera, Lepidoptera, Neuroptera, Hymenoptera, Diptera and Aptera; VI. *Vermes*, with the orders Intestina, Mollusca, Testacea, Lithophyta and Zoophyta. It was, however, in constituting and defining the genera that Linnæus showed in the highest degree his powers both of observation and of arrangement. The names of Pallas, Hunter and Blumenbach particularly are worthy of notice, but more than any other the name of Cuvier, who, like Linnæus, took a comprehensive view of the whole subject of zoology and carried forward the work of minute observation as well as of generalization. His system of classification is so vast an improvement on that of Linnæus as to be almost fundamentally new, and has formed a new starting point for all further progress.

He rejected the view, held by Lamarck, that a linear classification of the animal kingdom is possible, and in his great work, 'Le Règne Animal' (1817), he grouped his classes in four embranchements, representing four fundamentally distinct types of structure. These branches, with their contained classes, are as follows: *Vertebrata*, including Mammalia, Birds, Reptiles, Fishes; *Mollusca*, including Cephalopoda, Pteropoda, Gasteropoda, Acephala, Brachiopoda, Cirrhopoda; *Articulata*, including Annelides, Crustacea, Arachnides, Insects; and *Radiata*, including Echinoderms, Intestinal Worms, Acalephæ, Polypi, Infusoria. He raised comparative anatomy to the dignity of a true science, and he carried out researches of the utmost value in palæontology. In the restoration of extinct animals from remains of parts he used his law of the correlation of parts according to which animals are so constituted that single organs or parts can serve as an index to all other parts and to the general structure. The system of Cuvier has been extensively modified by many subsequent anatomists; notably Lamarck, De Blainville, Ehrenberg, Owen, Milne-Edwards, Von Siebold, Stannius, Leuckart, Agassiz, Huxley, Haeckel and others. The present state of classification must not be regarded as authoritative or final, since the rapid progress of knowledge is introducing incessant change in our conceptions of the relations of the greater groups. The reverse error must, however, be guarded against — that of supposing one classification as good as another, for each really marks a stage of progress.

Darwin and After.— The theory of the fixity of species was challenged at various times by different zoologists, notably by Lamarck, but it was not till the publication of 'The Origin of Species' (1859) by Charles Robert Darwin (1809–82) that the old view became generally abandoned and the evolution or development theory took its place. This has completely transformed the whole outlook of the zoologist and has brought new branches of the science into being, notably thremmatology. It makes the tree-like classification to which systematists have steadily advanced a truly genealogical tree, and it has contributed enormously to the progress of what may be called philosophical zool-

ogy. The natural-selection principle was independently discovered at practically the same time by Alfred R. Wallace (1823–1913), the eminent naturalist-traveler. Herbert Spencer had also formulated an evolution theory, extending to the whole of nature and life. Thomas Henry Huxley (1825–95), master of an admirably lucid and attractive method of exposition, and Ernst Hæckel (1834–), have done admirable work in embryology and other branches of zoology, and have contributed much to developing and popularizing the Darwinian views. August Weismann (1834–1914) is best known by his valuable contributions to the doctrine of heredity. The number of other zoologists who have done good work during the Darwinian period and under the influence of the Darwinian conceptions is so great that no attempt will be made to enumerate them.

Bibliography.—Lamarck, 'Philosophie Zoologique' (Paris 1809); Carus, 'Geschichte der Zoologie' (Leipzig 1872); Spencer, 'Principles of Biology' (London and New York 1898); Osborn, 'From the Greeks to Darwin' (New York 1894); Miall, 'Early Naturalists' (London 1912); 'Cambridge Natural History' (10 vols., New York 1895–1909); Lankester, E. R., 'Zoology' (ib. 1906); Parker and Haswell, 'Zoology' (2 vols., ib. 1910); *Zoological Record* (London, annually).

ZOÖMORPHIC, a word meaning pertaining to or exhibiting animal forms. In anthropology, representing a god or other supernatural being under the form of one of the lower animals. The zoömorphic element in classic mythology appears in such cases as that of the Smintheian Apollo, and the metamorphoses of Jupiter; it is very strongly marked in the religion of ancient Egypt, and traces of it may be found among the Jews and in the Apocalypse.

ZOÖPHYTE, a term meaning literally animal plants, borrowed from Aristotle by Cuvier, and used by him as a synonym of *Radiata*. The term has no longer any specific value, but is often loosely applied as a designation for many plant-like animals, as sponges, corals, etc., more or less resembling plants in appearance.

ZÖPFL, tsœpfl, **Heinrich Matthias,** German legal scholar: b. Bamberg, Upper Franconia, Bavaria, 6 April 1807; d. Heidelberg, 4 July 1877. Educated at Würzburg, he became a lecturer at Heidelberg in 1828, in 1839 professor extraordinary of constitutional law, and in 1842 professor ordinary. He was elected university representative in the first chamber of Baden in 1850, and sat in the Unionsparliament at Elfurt. Among his works are 'Grundsätze des Gemeinen Deutschen Staatsrechts' (1841; 5th ed., 1863), and 'Deutsche Staats- und Rechtsgeschichte' (1834–36; 4th ed. as 'Deutsche Rechtsgeschichte,' 1871–72).

ZORELLA ISLANDS, East Indies. See Xulla Islands.

ZORGITE, a mineral from Zorge and Tilkerode in the Harz. Massive; brittle; hardness, 2.5; specific gravity, 7 to 7.5; lustre, metallic; color, lead or sometimes yellowish gray. A selenide of lead and copper in varying amounts.

ZORILLA, or **ZORRILLA,** thō-rēl'yä, **Manuel Ruiz,** Spanish statesman: b. Burgo de Osma, province of Soria, 1834; d. Burgos, 13 June 1895. He studied law at Valladolid and became an advocate at Madrid, where in 1856 he was chosen to the Cortes, in which he identified himself with the Progressive party, and displayed a vigorous hostility against the Neo-Catholics. Banished in consequence of the insurrection of June 1866, he remained in France until the revolution of 1868, when Serrano appointed him Minister of Commerce, Education and Public Works. In 1869–70 he was Minister of Justice, and later president of the Cortes. He was a supporter of Duke Amadeus of Aosta for the Spanish throne, and when the latter became Amadeus I, was made Minister of Public Works. In 1872 he assumed the head of a radical ministry, but after Amadeus' abdication retired. Upon the accession of Alphonso XII in 1875 he went to France and for 18 years was the leader of the Spanish Republicans. He was continually under the observation of both the French and Spanish secret service officers and for his participation in the military revolt of March 1884, he was sentenced to death, although still on French soil. Broken in health and spirits, he at length abandoned his leadership and was permitted to return to Spain. Consult Villareal, 'Ruiz Zorilla desde la Expulsion de España hasta su Muerte 1875–95 (1903).

ZORN, tsôrn, **Anders Leonard,** Swedish painter: b. Utmedal, 18 Feb. 1860. He studied sculpture and painting at the Stockholm Academy. In 1882 he settled in London, where he attained special success as a portrait painter, and in 1889 went to Paris. He traveled widely in Sweden, Italy, Spain, England, the United States and elsewhere; while in the United States he painted several portraits. He ranks among the leading contemporary Swedish artists, and his work includes landscape, genre, portrait painting and sculpture, as well as etchings of great merit, which are chiefly copies of his own paintings. Among his paintings are 'Irish Maidens'; 'The Toast'; 'Italian Street Scene'; 'Summer in Sweden' (National Galleries, Berlin); 'Midsummer Night Dance at Dalecarlia' (National Museum, Stockholm); 'Nude' (Metropolitan Museum, New York), and portraits of Renan, King Oscar, King Charles of Sweden, of himself (Uffizi Galleries), Harald Wieselgren, etc.

ZORN, Philipp, German jurist: b. Bayreuth, 13 Jan. 1850. After study at Munich and Leipzig, he became a lecturer at Munich in 1875, and in that year went as professor to Bern. From 1877 he was at Königsberg, and in 1900 took a chair in the legal faculty at Bonn. In 1899 he participated as an expert in the Peace Conference at The Hague. Among his works are 'Staat und Kirche in Norwegen bis zum Ende des 13ten Jahrhunderts' (1875); 'Staat und Kirche in der Schweiz' (with Gareis 1877–78); 'Staatsrecht des Deutschen Reichs' (2d ed., 1894–97); 'Deutsche Kolonialgesetzgebung' (1901), and 'Die Deutsche Staatssprache' (1903); 'Die Deutsche Reichverfassung' (1907); 'Staats-und Verwaltungsrecht' (1914), etc.

ZORNDORF, tsôrn'dôrf, Germany, a village of Brandenburg, Prussia, 53 miles northeast of Berlin. It is celebrated for the Prussian victory won by Frederick the Great over the

Russians under General Fermor, 25 Aug. 1758, the Russians losing 21,529 men and the Prussians about 11,000. See SEVEN YEARS' WAR. Pop. 988.

ZOROASTER, religious reformer of ancient Persia. Termed Zarathustra in the Avesta or primitive Iranian code, and in later Persian Zardusht, its meaning has been variously interpreted — one of its roots is undoubtedly "camel." Its modern form Zoroaster was adopted from the Greek and Latin. The story of his birth and activities has little authentic basis, although his historic personality is admitted. All details are scanty, and it is impossible to distinguish between legend and fact, as is true in general of old time founders of religions, whose personality and exploits later ages have magnified out of all proportion to their real stature and deeds.

Greek and Roman writers make frequent mention of him as founder of the wisdom of the Magi and tell of his childhood and solitary life. Plato in his 'Alcibiades' (I, p. 122) makes one of the earliest references. Pliny, Plutarch, Dio Chrysostom are explicit in their accounts, which border on the miraculous. No mention is made, as might be expected, in the cuneiform inscriptions of the Achaemenidæ, the ancestral royal line of Persia, although Darius and his successors were loyal followers of the prophet. Darmesteter terms Zoroaster a myth, the incarnation of the storm-god. As Dr. Geldner states, however, the French scholar does not distinguish between the Zoroaster of the younger Avesta and of the Gathas, or "songs," in which the very words of the sage are expressed, his authentic sayings, the last survivals of the sermons which he spoke at the court of King Vishtospa. In these psalms, hymns, or songs, he appears as a man on solid ground, like some later world-prophet, with his alternation of confidence and despair, but with his hold on God firmly retained in all changes of fortune. The Gathas, on the other hand, furnish no precise historical data, merely a number of verses that allude to personal events interwoven with sage reflections and counsel — a kind of modern pastoral admonition. A comparison to the Psalms of David will illustrate this point of literary content to a certain degree.

Admitting, then, his historical personality, what do the Persian traditions tell of his origin? His father bore the title Spitama, indicating a noble line; his mother's name, too, is mentioned. His birthplace was on the hill of the river Darga (Darya). Another legend traces his birth to Ragha in Media, the seat of the imperial hereditary church in Sassanian times. Like others of his type — Mohammed, for example — he had heavenly visions in early years and conversed with archangels and the Highest. At the age of 30 he had a celestial vision on the banks of the river. An angel invited him to a conference with Mazda, or the Highest, a symbol of the new era and religion which he was to found, abolishing the crude notions of his age and environment and developing a loftier ideal of the Supreme and humanity. Sent by Mazda to the court of King Vishtaspa, king of Bactria in epic legend, he suffered indignities at first and was thrown into prison — how familiar these points in the narrative! Then on gaining his liberty, he converted to the new faith the king himself, wife, brother and the two viziers, all of whom became ardent devotees and gave strength to the cause, despite the many severe trials it had to endure. Finally, on an invasion of the kingdom, Zoroaster was slain in his 77th year by a Turanian. His sons and daughters are frequently mentioned. As to the date of Zoroaster, the chronology is obscure. The time of his birth varies from the extravagance of Greek writers who place him 5,000 years before the Trojan War to the Parsee tradition, which puts his birth at 660 B.C. and his death at 583 B.C. Edward Meyer and Duncker give 1000 B.C. as date of his birth, after careful study of available sources.

While the doctrines in general of Zoroastrianism are discussed elsewhere, the personal declarations of its founder as expressed, as before stated, in the Gathas, are eminently quotable. His conviction of his mission and its sacred message is breathed in the words "I am thy chosen one from the beginning; all others I consider my opponents." "To thee I cry: Behold, O Lord, and grant me assistance as a friend grants it to a dear friend," so sounds his appeal. "Tell me right, O Lord — will the good deeds of men be rewarded already before the best life comes?" is his inspiring question. "Who sustains the earth here below, and the space above, that they do not fall? Who made the waters and the plants? Who has yoked to the winds the storm clouds, the two swiftest of things?" is in the spirit of Job's glorification of the Creator. Consult Jackson, A. V. W., 'Zoroaster, the Prophet of Ancient Iran' (New York 1899); Ragozin, Z. A., 'The Story of Media, Babylon and Persia' (New York 1888).

ZOROASTRIANISM, the religious system of ancient Persia as founded by Zoroaster, whose religious teachings are preserved in the Avesta, one of the world's oldest sacred books. The character of the Persian religion in pre-zoroastrian times has been a frequent subject of inquiry, but while nothing authentic is known, there is every reason to infer a certain similarity with the ancient faith of the Hindus. Iran and India were not so distant from each other as to make impossible communication one with the other. If we turn to Herodotus as informant (Hist. i, 31ff.) the Persians are said to have worshipped from antiquity the sun, moon and stars, the earth, the waters and the wind, the crassest polytheism. He intimates also that they borrowed some religious notions from Assyria and practised certain rites against which the prophet protested. His account too of the Magian ceremonies indicates that they were not inconsonant with Zoroastrianism. Ed Meyer in the *Reports* of the Prussian Academy (1908) shows how recently discovered Hittite inscriptions have a distinct bearing on the old creed of Iran upon which the religion of the prophet was based, that Aryan folk-religion, polytheistic in its nature, many of whose divinities, Mitra and the rest, are not strangers in the Indian pantheon, while diversities as well as similarities abound in the theologies of both.

Dualism. — The first characteristic element of Zoroastrianism is its doctrine of dualism.

which personifies the opposing principles of good and evil, and recognizes the universal sway of these hostile forces. Briefly to describe this vital feature, the powers of good are led by Sharamazda or Ormuzd ("the Wise Lord"); those of evil by Ahriman ("the Spiritual Foe"). These opposing hosts, as if trained to combat and command by Oriental despots, have in their return an array of warriors, with the skill and persistency of actual armies. On one side are bands of angels and archangels; on the other companies of demons and archfiends. Under the general name of Amesha Spentas ("Immortal Holy Ones") are grouped the six archangels, who personify fundamental virtues and abstract ideas, and whose Persian names represent "Good Mind," "Perfect Righteousness," "Wished of a Kingdom," "Earthly Harmony," "Salvation," "Immortality." In addition, are a number of angels and lesser divinities, called "Worshipful Ones" who are more eminent than the rest, and include divine personifications of the planets, fire, air, water, the spirits of the righteous ("*fravashis*"), and some abstract notions like religion, glory, victory, Mithra, a divinity who incarnates light and truth. The opposing army, commanded by Ahriman, is less disciplined. Its chief archfiend is the demon Æshma (*Daeva*). A crowd of lesser fiends and demons ("*daeva*," "*druy*") accompany the six archfiends.

The Millennium.— The world's history is nothing but the story of the contest between good and evil, light and darkness, which shall endure for 12,000 years, divided into four periods of 3,000 years each. The first period is one of spiritual existence. Conscious that Ahriman lives, Ormuzd makes the world a spiritual creation before it assumes the material form. When Ahriman discovers his enemy at work, he arouses to life his army of demons and fiends. In the second Epoch Ormuzd creates the material world, which is invaded by Ahriman and his cohorts. The third period marks the contest for mastery between the rivals and the battle for the human soul until Zoroaster is born. A new Epoch is now commenced, as the fourth and last 3,000 years begins. The prophet and his three sons, to be born in ages to come, the last being the Messiah, liberally "he who will benefit and save the world," preside over the final eon. This dualism is an approach to monotheism, as it teaches the ultimate sway of Ormuzd — its hopeful philosophy of the world's regeneration is not to be overlooked. Throughout the conflict, man is the chief factor, for all depends upon his choice as free agent, of the good. The final aim of Zoroaster's system is to assure world perfection by the individual's adoption of the right path. This will come to pass, with the setting up of the "Good Kingdom," the "Wished for Kingdom," or the "Kingdom of Desire," as the Avesta expresses it. As the world enters the stage of regeneration, Ahriman forms his hosts for a final battle. They are defeated, and good is to reign forever. Accompanying the advent of the Messiah (*Saoshyant*) occur the resurrection of the dead and the judgment of the world, to be.

Code of Ethics.— One sometimes overvalues old-time ethical codes, because we are apt to emphasize their good features. A study of the ethics of Zoroastrianism cannot but arouse admiration for their lofty qualities. They bear the stamp naturally of their environment, but in moral elevation do not yield to standards that we term modern and of which we are justly proud. A fair idea of their character can be gathered from the profession of faith required from converts and preserved in its entirety in the Avesta. These few paragraphs are condensed from Professor Jackson's translation in Ragozin's 'Media' (p. 111): "I forswear henceforth all robbing and stealing of cattle and the plundering and destruction of villages belonging to worshippers of Mazda. I promise householders that they may roam at will and abide unmolested, wherever dwelling with their herds; I swear this with uplifted hands. Nor will I bring plunder or destruction, not even or avenge life and limb. I confess myself a worshipper of Mazda, a follower of Zarathustra. I profess good thoughts, good words, good deeds" — which last phrase is the motto of the religion of Zoroaster and is found throughout his sayings and injunctions. Each day man must preserve the purity of body and soul. Earth, air and water are to be kept free from defilement. To speak the truth and act honestly are fundamental; to be kind and generous the highest duty. To till the field and raise cattle, are part of one's religious requirements. Marriage is insisted upon, even among kindred. The deed, the action, is the only source of salvation. God is manifested in virtuous thoughts, words, deeds.

Ritual.— In the Gathas, which, as before stated, is the scanty source of Zoroastrian personal teaching, there is little, if any, mention of ritual or ceremonials. He is less the lawgiver there than the prophet, it has been aptly stated. Yet a full ceremonial worship developed, the priesthood was at the head and its office was hereditary, with the Mobeds and Herveds, the Levites and Kohanim of Zoroastrianism. The Magi were of Median origin. Annual sacrifices were originally offered but were less and less insisted upon as praise and thanksgivings took their place with oblations of consecrated milk, water and bread. Lengthy litanies accompanied these rites, which were of special significance in connection with the preparation of "haoma," the sacred drink, like the Indian "Soma." A curious practice arose in the disposal of the dead. No bodies could be burnt, buried, or thrown into the water, as thereby defilement to the elements would be caused, they were consigned to high places, to be devoured by dogs and birds, a custom still in vogue among the Parsees and Gabars in their so-called "Towers of Silence." Practices of abstinence and asceticism, what is termed "mortification of the flesh" are not encouraged but are condemned as foolish and wicked and as strengthening the arch enemy's hands. The excessive reverence paid to Fire, which won for the Zoroastrians the name of "Fire-worshippers," was a later development as were numerous forms of incantation and purification.

Resemblances to Judaism and Christianity.— These are many and striking. Ahuramazda, supreme Ruler, with the attributes of

omniscience, omnipresence and eternity, with creative power which he employs through his Spenta Mainya, or "Holy Spirit," with the best of angels and archangels in his train, suggests unmistakably the Old Testament Yahveh, especially in certain books, written under later influences, and which appeared more magnified in the Gospels. So Ahriman, Ormuzd's adversary, reminds one of Satan in later epochs, and whose future end is similar; these, too, are almost parallel ideas as to the world's regeneration the Messiah, the resurrection of the dead and everlasting life. Zoroaster receives his law from Aheramazda on the "Mountain of the Two Holy Communing Ones," as does Moses on Sinai. There are six periods of creation in the Avesta like the six days in Genesis, and a single pair, Moshya and Moshyana, like Adam and Eve. The deluge of the Bible is paralleled by the devastating winter. Shem, Ham and Japhet are recalled by the three sons in the Avesta. Similarities in ritual details are many and have been studied at length. Here as is usual the critics disagree. The larger number trace these analogies to the influence exerted on Judiaism by Zoroastrianism during their period of the Exile, if not earlier. On the other hand, the contrary view, advocated by James Darmesteter, is held by some—that early Persian thought was influenced by Judaism, and that Neoplatonism, through Philo, left also its mark on the Avesta. It is impossible at present to decide definitely the point at issue; one must await fresh discoveries and identifications in the East, to give us more exact knowledge. Perhaps a common influence was at the root of both Jewish and Persian ideas.

Historical Growth.—While Zoroastrianism was the national religion of Persia, it was accepted by Turamans as well as Iromons, and spread to Armenia, Cappodocia and the entire near East. With the Sassanides, the national church was restored, and the priesthood became strongly organized with unlimited power and an authoritative religious lawbook. The head of the hierarchy, with his seat at Rai in Media, was next in power to the king. New sects now began to arise, but the Mohammedan onset in 636 with the persecutions that followed, spelled overthrow to the religion of Zoroaster. Today only a few followers of the prophet are found even in Persia. In and around Bombay the Parsees, limited in number, profess allegiance to him and his religion, but the creed has developed into a pure monotheism.

Bibliography.—In addition to Jackson and Ragozin as given above, consult Jackson, 'Grandriss der iranischen Philologie' (11.612ff. Strassburg 1896-1904); Karaka, 'History of the Parsis' (London 1884); Lehmann, 'Zara thustra' (Copenhagen 1899–1900); Moffat, 'Zoroastrianism and Primitive Christianity' (in *Hibbert Journal*, 1903, 1768–1780). As to analogies with Judaism, consult treatises by Kohut, Schoer, Stabe, while for the general student are the works of Schrader, Spiegel and West, E. W.

ZORILLA Y MORAL, José, hō-sā' thōr-rēl'yä ē mō-räl', Spanish poet: b. Valladolid, 21 Feb. 1817; d. Madrid, 23 Jan. 1893. He studied for the law at Toledo and Valladolid, but turned to literature. His attempts in politics showed him to be unfitted for such a career. From 1855 to 1866 he was in Mexico, latterly at the court of Maximilian. His plays, of which 'Don Juan Tenorio' is now the best known and is still a great favorite in Spain. Others are 'El zapatera y el rey'; 'Traidor, inconfeso y mártir'; 'El Alcalde Rouquillo' and 'El Rey loco.' The plays were hastily written and are without finish, but have continued effective through their strong appeal to national patriotism, and their adaptability to theatrical requisites. His 'Leyenda de Alhamar,' 'Granada' and 'Leyenda del Cid' were picturesque presentations of national legends in the general manner of Scott, and very popular. Zorrilla was not a careful artist, but an improvisator of great readiness and skill, both lyrical and dramatic. He suffered bitter poverty in 1871–83, for, although his plays were still highly successful, they were not protected by copyright. He later received a government pension of 30,000 reales; was awarded the gold medal of the Spanish Academy in 1885, and in 1889 was crowned national laureate at Granada. A bronze memorial was erected to him in Madrid in 1900. An account of him may be found in the autobiographic 'Recuerdos del Tiempo Viejo' (Old-Time Memories, 1880–83), which work, however, is not wholly dependable. His collected works were published (Madrid, 4 vols., 1895; 1905).

ZOSIMUS, zŏs'ĭ-mŭs (Gr. Ζώσιμος), Greek historian of the 5th century A.D. He lived at Constantinople and wrote a history of the empire in six books, the 'New History,' which is frequently referred to by Gibbon. He begins with the change of constitution introduced by Augustus, and his first book brings him to the reign of Diocletian, 305 A.D.; in the second, third and fourth books the history of the 4th century is given with more detail; the fifth and sixth books are occupied with the period from 395 to 410. From internal evidence the work must have been written about 450–502. Zosimus was a pagan, and severely criticized the Christian emperors, making the change of religion largely responsible for the decline of the empire. His work is on the whole trustworthy, but his pagan bias in some instances leads him to various misinterpretations of the acts of the Christians. The best editions are those of Bekker (1837) and Mendelssohn (1887).

ZOSTERA, a genus of marine plants. See EEL-GRASS.

ZOTAL. See MESCAL.

ZOUAVE, zoo-äv, a soldier in the French army. Zouaves were organized in 1831 and were originally mercenaries belonging to a Kabyle tribe. The Zouaves in the pay of the dey of Algiers were, when Algeria became a French possession, incorporated with the French army there, preserving their Arab dress. Ultimately the native element was eliminated, and the Zouaves became French soldiers in the picturesque Arab costume. As such they distinguished themselves in the Crimea, which was their first European service, and the Franco-Italian War of 1859. There were several regiments of Zouaves among the volunteer Federal troops in the American Civil War, so-called because of their wearing an adaptation of the costume of the French Zouaves. The

Papal or Pontifical Zouaves were recruited from French soldiers at Rome in 1860 and under General Lamoricière, a former commander in Algeria, defended the temporal sovereignty of the Pope. They were unsuccessful against the Italian troops at Rome in 1870, and after serving in France against the Germans and the Commune they were disbanded in 1871.

ZOUCHE, Richard, English legal scholar: b. Anstey, Wiltshire, 1590; d. London, 1 March 1661. He was educated at New College, Oxford; in 1617 was admitted an advocate of Doctors' Commons, and in 1620 became regius professor of civil law at Oxford. In addition to his university duties he had a large practice in London. In 1641 he was made judge of the High Court of Admiralty. He was a Royalist, though not a pronounced one, at the civil war; and, although replaced in the judgeship in 1649, was nevertheless appointed by Cromwell to a special commission of oyer and terminer, and retained his academic appointments. He was regarded with some suspicion by both political parties; but after the Restoration he was appointed to the commission which reinstated the professors and Fellows of Oxford who had been removed under the Protectorate of Cromwell. On 4 Feb. 1661 he was restored to the bench. His writings include a descriptive poem, 'The Dove, or Passages of Cosmography' (1613); a comedy, 'The Sophister' (1639), and many works of a professional sort, most important of which are 'Elementa Jurisprudentiæ' (1629), a general system of legal science, and 'Juris et Judicii Fecialis Explicatio' (1650), regarded by critics as the first treatise containing a systematized arrangement of what is now known as international law.

ZRINYI, zrēn'yē, **Niklas (Miklós),** COUNT, Hungarian soldier: b. 1508; d. Szigetvár, 7 Sept. 1566. He distinguished himself in the siege of Vienna by Charles V, and in campaigns against John Zápolya and Sultan Suleiman. As ban of Croatia from 1542, he defended that territory against the Turks, and became famous for his defense of Szigetvár (or Sziget) in 1566. His garrison of scarcely 3,000 was reduced to 600, and on 5 September the enemy succeeded in firing the outer fortifications. Zrinyi retreated to the inner fortress, but this also was soon on fire. He thereupon ordered the gates to be opened, and after firing a mortar filled with broken iron into the midst of the Turks, who were surging along a narrow approach to the castle, led a sally of the garrison. He fell, mortally wounded, and the defenders were forced back, but a slow match ignited 3,000 pounds of gunpowder stored within, and great carnage among the Turks ensued. The catastrophe has been made by Theodor Körner the subject of his 'Zrinyi: Ein Trauerspiel.'

ZSCHOKKE, chŏk'kĕ, **Johann Heinrich Daniel,** Swiss author: b. Magdeburg, Germany, 22 March 1771; d. Blumenhalde, near Aarau, 27 June 1848. He left his native place in 1788, and for some time wandered about the country as play-writer to a strolling company of actors, but afterward studied at the University of Frankfort-on-the-Oder. In 1792 he began life there as a private teacher, and produced several pieces for the stage. He subsequently settled down in the canton of the Grisons and became director of an academy at Reichenau, where he wrote a history of the Grisons (1798). He then became head of the department of public instruction at Aarau, and was soon afterward sent by the Helvetic executive directory to Unterwalden as government commissioner, for the purpose of restoring tranquillity. He acquitted himself so satisfactorily that his powers as commissioner were extended to the cantons of Uri, Schwyz and Zug. In 1800 he was appointed commissioner for the organization of the Italian territories of Switzerland. In 1804 he became a member of the board of mines and forests, and in the same year began the issue of his highly popular *Schweizerbote* (*Swiss Messenger*). Through the greater part of his life Zschokke appeared as one of the most distinguished and energetic public men in Switzerland, but he found time to cultivate his favorite literary pursuits, and it is chiefly by his numerous writings, historical and fictitious, that he is known to the world at large. Among his works may be mentioned 'Ueberlieferungen zur Geschichte unserer Zeit' (1811–27) (Contributions to the History of Our Time); 'Des Schweizerlandes Geschichte für das Schweizervolk' 1822) (History of Switzerland for the Swiss People), one of the best of his works, and 'Bilder aus der Schweiz' (1824–26) (Pictures from Switzerland). As a writer of tales he possesses a European reputation, and among them we may refer more especially to 'The Creole,' 'Alamontade,' 'Jonathan Frock,' 'Clementine,' 'Oswald or the Goldmakers' Village' and 'Master Jordan.' The work, however, which has had the most extended circulation is his 'Stunden der Andacht' (Hours of Devotion) (1809–16; 27 editions in his lifetime), which, though rationalistic, has yet, from the pious feeling pervading it, found admirers among all classes of readers. Editions of his works were published (40 vols., 1824–28; 35 vols., 1851–54), and an edition of his 'Novellen' (12 vols., 1904). Consult the studies by Münch (1831); Keller, 'Beiträge zur Politische, Thätigkeit Zschokkes' (1887), and Wernly (1894).

ZUAZO, thoo-ā'thō, **Alonso,** Spanish jurist in the New World: b. Olmedo, 1466; d. Santo Domingo, West Indies, 1527. A learned canon of Valladolid, he was appointed jurist of the commission which, at the request of Las Casas, was sent to the New World. He was given authority to organize justice in the West Indies, and to appoint judges. For his opposition to the complete abolition of enforced labor, he was denounced by Las Casas, although in Santo Domingo he emancipated the Indians who had been held in slavery by the officials. In 1518 he was dispatched to Cuba to systematize the administration of justice in the island, and from 1525 until his death was auditor of the audiencia of Santo Domingo. Icazbalceta, in the 'Colleción de Documentos para la Historia de México' (1858–66), gives an interesting narrative, written by Zuazo from Cuba in 1521, regarding the condition of the natives there and in Santo Domingo.

ZUBLY, John Joachim, American Independent Presbyterian clergyman: b. Saint Gall, Switzerland, 1725; d. Savannah, Ga., 23 July 1781. The date of his arrival in America is

unknown, but in 1760 he became the first regular pastor of the Independent Presbyterian Church in Savannah, coming thither, according to the church record, from Wando Neck, S. C., where he was located prior to 1758. In 1775, at the provincial congress of 4 July, he was one of five delegates elected to represent Georgia in the Continental Congress, and was selected to draft a petition to the king regarding the "unhappy situation of affairs." In a letter of 3 Sept. 1775 to the Earl of Dartmouth, he denounced the suggestions made in England of arming the slaves to bring the Southern provinces to obedience. He took part in the adjourned session of the Continental Congress assembled 13 Sept. 1775. When he discovered the intention of the Congress to declare the independence of the United States, he revealed to Sir James Wright, royal governor of Georgia, the plans being made. One of the letters was seized, and Samuel Chase, of Maryland, referred to the fact on the floor of Congress. Zubly hastily withdrew, and in Georgia openly made common cause with the Tories. In 1777 he was banished, and half of his estate seized. He remained in South Carolina until the royal government was re-established in 1779. He then resumed his work as a pastor and continued it until his death, which occurred before the end of the war. He was an eloquent and learned preacher. Consult Jones, C. C., 'History of Georgia.' Vol. II (1883).

ZUCCARELLI, dzoo-kä-rĕl'lē, or **ZUCCHERELLI, Francesco,** Italian painter: b. Pitigliano, Tuscany, 1702; d. Florence, 30 Dec. 1788. He studied painting at Florence and Rome, and after gaining some success in decorative landscape, worked for five years in London decorating the Opera-House and executing views of the Thames. He returned to England in 1752 and became well known in London, where he was patronized by the royal family, especially the Prince of Wales, and the aristocracy. He was one of the original members of the Royal Academy in 1768. After 1773 he lived in his native country. He painted landscapes principally, his work inclining to the classic, the best examples of it ranking with that of his leading contemporaries; but he also executed much of an inferior quality. He frequently painted a tiny pumpkin as a signature, his name meaning "little pumpkin." Numerous examples of his art are in Venice, the Palazzo Reale containing 21. A large number, too, are in Windsor Castle, and he is also represented in Glasgow, Edinburgh, Paris (Louvre), Petrograd (Hermitage), Milan (Brera), and other cities.

ZUCCARO, dzook-kä'rō, or **ZUCCHERO, Federigo,** Italian painter: b. Sant' Agnolo in Vado (Urbino) 1543; d. Ancona, 1609. He studied under his brother Taddeo in Rome, and was employed by Gregory XIII to paint the vault of the Cappella Paolina in the Vatican, but having quarreled with some papal officials and painted a scurrilous picture he fled to France and ultimately reached England in 1574. There he painted portraits of Queen Elizabeth, the Earl of Leicester and other distinguished persons (21 were exhibited in 1866), and afterward worked in Venice until he returned to Rome to complete his work in the Cappella Paolina. On the invitation of Philip II he went to Madrid in 1586 to paint for the Escorial, and on his return to Rome he founded the Accademia San Luca, of which he became the first president. Many portraits of English personages in the Elizabethan era are wrongly ascribed to him, but some genuine works from his brush are extant. He was also something of an architect and sculptor. His frescoes, painted on an enormous scale and crowded with figures, gave him a great reputation during his lifetime; but modern criticism places his easel paintings far above them. Among his easel-works are 'Deposition from the Cross' (Palazzo Borghese, Rome); 'Descent of Christ into Limbo' (Brera, Milan)); 'Sir Walter Raleigh' (Kensington Gallery); 'The Resurrection' (Borghese).

ZUCCHI, dzook'kē, **Antonio Pietro,** Italian painter: b. Venice, 1726; d. Rome, 25 Dec. 1795. In 1754 he accompanied the English architect Robert Adam on his journeys in Italy and Dalmatia, and on Adam's invitation he went to England in 1766. He decorated the interiors of several of the mansions built or altered by Adam, such as Caen Wood (Hampstead), Luton House (Bedfordshire), Osterley House (near Brentford), and Sion House (Middlesex). In 1770 he was elected an associate of the recently established Royal Academy. He married M. A. C. Kauffman (q.v.), better known as "Angelica Kauffman," in 1781 and afterward lived in Rome.

ZUCHETTO, tsŭk-kĕt'tō, or **ZUCHETTA,** the skull cap of a Roman Catholic ecclesiastic covering the tonsure. That of a priest is black, of a bishop or monsignor purple, of a cardinal red, and of the pope white.

ZUEBLIN, Charles, American sociologist: b. Pendleton, Ind., 4 May 1866. He studied at the University of Pennsylvania, was graduated at Northwestern University in 1887 and at Yale in 1889, later studying at Leipzig. He became an instructor in sociology at the University of Chicago in 1892; was assistant professor in 1895; associate professor from 1895 to 1902; and was professor of sociology there in 1902–08. He edited the *Twentieth Century Magazine* in 1911–12. He is well known as a lecturer and magazine contributor. Author of 'American Municipal Progress' (1902); 'A Decade of Civic Development' (1905); 'Religion and a Democrat' (1905); 'Democracy and the Overman' (1911), etc.

ZUG, tsoog or zoog, Switzerland; (1) The capital of the canton of the same name, on the northeast shore of Lake Zug, 12 miles by rail northeast of Lucerne. It is popular as a pleasure resort and has fine scenery although it is located in the hilly rather than the mountainous part of Switzerland. The earliest mention of the town is in 1240. It has splendid old mansions and strong watch-towers; several interesting churches; a Capuchin monastery and a convent; a cantonal government building in Renaissance style; a fine town-house in late Gothic style, with a museum of antiquities; an arsenal; manufactures of cottons, enamel-ware, metal goods, tobacco, cigars, soap, etc. In 1435, 1594 and 1887 portions of the town sank into the lake. Pop. about 8,038. (2) A central and the smallest undivided canton

of Switzerland, bounded by Zürich, Schwyz, Lucerne and Aargau, and connected by rail with Zurich and Lucerne. The surface, which is generally mountainous in the southeast and south, where the Rossberg occupies the frontier, slopes more or less gradually north and west till it becomes comparatively flat. The portion of Lake Zug within its borders occupies 10 square miles; while Lake Ægeri, wholly within its borders, occupies two and three-fourths square miles. Of its total area of 92 square miles about 75 square miles are under cultivation. The battle of Morgarten, won by the Swiss 5 Nov. 1315, was fought within its boundaries. The climate, rigorous in the mountainous districts, is mild on the lower southern slopes. The chief exports are cattle, fruits, cider and "kirschwasser." Pop. about 20,013. (3) A lake chiefly in the canton of Zug, but partly also in Lucerne and Schwyz. It is 1,368 feet above sea-level; 12 miles long north to south, and varies in breadth from three miles to one mile at the centre. The shores are low in all directions except the south and southeast. In the former direction the Righi, with Mount Pilatus towering behind it, and in the latter the Rufiberg or Rossberg (5,195 feet), rise in abrupt and lofty precipices, presenting scenery of the grandest description. At the foot of the Rossberg the depth of the lake is not less than 650 feet. Steamers ply upon it, and the fishing, principally of pike and carp, is very productive.

ZUIDER-ZEE, zī'dĕr zē (Dutch, *soi'dĕr-sā*), or **ZUYDER ZEE**, or **SOUTH SEA** (as opposed to the North Sea), Netherlands, a large gulf pentrating deeply between the provinces of Friesland, Overyssel, Gelderland, Utrecht and North Holland; about 80 miles long, 45 miles greatest breadth, but only 10 miles broad between Enkhuizen and Stavoren. The islands Texel, Vlieland, Terschelling, Ameland, and several smaller islands separate it from the North Sea, with which it communicates by various channels, the principal being Marsdiep, between the Helder and Texel, and the Vlie Strom between Vlieland and Terchelling. It contains the islands of Wieringen, Marken, Urk, and Schokland, and numerous sandbanks, especially in its northern portion; has on its shores numerous towns, and receives the waters of the Yssel, Vecht, Eem Kuinder, and other streams; but is generally shallow, and only navigable by vessels of small draft, much of its area being only three feet in depth, while its maximum depth, in the southern portion of the former lake, is only 19 feet. Oysters and plaice are plentiful. The Zuider-Zee is of modern origin, having been formed chiefly since the 12th century by successive irruptions of the sea. In earlier times there were here only a lake and marshes, the lake being called Flevo by Pliny and Tacitus. The reclamation of the greater portion of the Zuider-Zee has long been a pet project with the Dutch and plans for the work were formulated as early as 1886. But while the area thus available was much to be desired, financial considerations barred the way for many years. However, a bill authorizing the work which is to create a new province became a law 14 June 1918. The area to be reclaimed is 523,000 acres, of which it is estimated about 475,000 will be fertile. The completion of the work will require 15 years and the cost is figured at 66,250,000 florins. A dike is to be built from the island of Weiringen to the coast of Friesland, a distance of 15 miles; and the land then drained and prepared for cultivation.

ZULIA, thoo'lē-ä, Venezuela, the most northwestern state of the republic, surrounding Lake Maracaibo (q.v.), bounded on the west by Colombia and on the east by Falcón. It was formerly united with Falcón, but is now politically independent. Lake Maracaibo is surrounded by low lands, but a great part of the rest of the province is mountainous. Agriculture is the chief industry; coffee, sugar and cacao are raised. Area, 24,969 square miles; pop. 100,000. Zulia is also the name of a famous trade route connecting northeastern Colombia with the Venezuelan port of Maracaibo. The Zulia River forms a part of this route. The navigation of the latter river has often been the subject of international controversy between Colombia and Venezuela.

ZULOAGA, thoo-lō-ä'gä, **Félix**, Mexican politician, president of the republic; b. Alamos, Chihuahua, 1814; d. Mexico, 1876. Having entered the national guard as a lieutenant, he fought against the Yucatan secessionists in 1842–43, on the conclusion of which he was promoted to the rank of lieutenant-colonel. In preparation for the war with the United States he directed the fortification of Monterey, Saltillo and the southerly approaches of the capital. From 1848 to 1853 he was not in active service. In the latter year he was promoted colonel, and subsequently variously employed. On 17 Dec. 1857 he conspired against the Liberal government, and finally on 11 Jan. 1858 the brigade of which he was the commander declared Comonfort (see COMONFORT, YGNACIO) deposed and Zuloaga president. Zuloaga entered on the office 23 January, and the "War of Reform" began, the Liberals being under the leadership of Benito Juárez. In December the garrison deposed Zuloaga, who finally resigned, and appointed as a substitute General Miramon (q.v.), who assumed office 2 February. In 1860 Zuloaga published a manifesto proclaiming himself constitutional president, but subsequently he came to an agreement with Miramón. When the French invaded Mexico in 1862, he withdrew, but in 1864 he returned and submitted to the empire and promised fealty to Maximilian. This promise he broke and attempted, in 1865, to overthrow Maximilian; but he was unsuccessful.

ZULOAGA, Ignacio, Spanish painter; b. Eibar, a town in the Basque provinces, 1870. He is descended from a family of artistic craftsmen, his father having been a noted damascener (Placida Zuloaga), and his great-grandfather the organizer and director of the royal armory at Madrid. He was at first sent to Rome to study architecture, but subsequently turned to painting and spent five years in Paris. Here he devoted himself to the private study of the old Spanish masters, and produced his first work which was exhibited at the Paris Salon (1890). Zuloaga then returned to his native country, and after a long struggle for recognition, rose to the foremost rank as a truly representative Spanish artist.

He modeled his work on the style of the old Spanish masters, painting directly without preliminary drawings, with strong sure lines and splendid imagination. His works are to be found in the leading cities of Europe and also in the United States. The American Hispanic Society, which presented an exhibit in the United States in 1908, possesses a half-portrait of Zuloaga, 'The Gypsy Bull Fighter's Family' and 'Mlle. Lucianne Bréval as Carmen.' Canvases that are well known abroad are his 'Avant la Corrida' (Brussels Museum); 'Don Miguel' (Vienna Gallery); 'Portrait of a Lady' (Pan Museum); 'Amies' (Barcelona); 'Madame Louise' (Venice); 'The Topers' (Berlin). Zuloaga has also painted a number of pictures in propaganda for the arousing of his country to a national consciousness of the evils which beset it, principally from the excessive power of the church and the degrading indulgence in bull-fighting. The most striking of these are his 'Cardinal'; 'The Victim of the Feast'; 'The Idols of the People'; 'The Brotherhood of Christ Crucified.' In 1917, exhibits were held in several cities in the United States, which won enthusiastic praise. Among those which were particularly noticed were 'Portrait of Maurice Barrés'; 'My Uncle Daniel and His Family'; 'Anita Ramirez'; 'Basque Peasant,' and several fine portraits of ladies. The colors used are generally sombre, occasionally heightened by bright contrasting hues. The treatment of the subject is intensely realistic, often brutal in its impassioned sincerity. Yet his work always makes, through its imaginative quality, a certain spiritual, almost mystic, æsthetic appeal. The choice of detail is deliberate and careful; and the subject matter well conceived and arranged. Consult Brinton, Christian, 'Modern Artists' (New York 1909); Utrillo and Others, 'Five Essays on the Art of Ignacia Zuloaga' (New York 1909); 'Catalogue of Paintings by Ignacia Zuloaga, Exhibited at the Hispanic Society of America' (ib.); Sargent, J. S., 'Ignacio Zuloaga,' and Wyer, R., 'Ignacio Zuloaga's Exhibition' (in *International Studio*, December 1916).

ZULULAND, zoo'loo-länd, South Africa, a country lying on the southeast coast of Africa, now a province of Natal, and since 31 May 1910 a part of the South African Union; it is bounded on the north by Portuguese East Africa and the Transvaal and on the west by the Orange Free State. Area, 10,424 square miles. The principal rivers are the Tugela, on the Natal boundary; the Buffalo, which joins the Tugela on the left, about midway up the Natal frontier, and forms the remaining portion of the boundary between Natal and Zululand; and the Umvolosi, which flows into Saint Lucia Bay. From the coast at Saint Lucia a range of mountains called the Libombo range runs northward nearly parallel to the coast, separating the country into two regions. The coast region is malarial, but fertile, and is cultivated chiefly by the whites. The inland region is comparatively healthful and is fertile. Rich gold reefs have been found, and excellent coal exists. The coal is being worked and a railway has been constructed for 98 miles along the coast, extending north from Durbar. There are great plantations of sugar, tea, cereals, fruits and vegetables. The country, which was on 30 Dec. 1897 annexed to the colony of Natal, is mainly inhabited by the Zulus, who have long been distinguished as the most warlike of the Kaffir tribes. The country inhabited by the Zulus was formerly much more extensive. In the beginning of 1879 the Zulu king, Cetewayo or Ketchwayo, with a large army of fairly disciplined troops armed with rifles, came into collision with the British in South Africa. This was partly due to a long-standing dispute as to the claims of the Zulus to the Utrecht district in the southeastern angle of the Transvaal, partly to other causes, which at last induced Sir Bartle Frere, the governor-general of the British provinces in South Africa, to send an ultimatum to Cetewayo. To this no reply was sent, and war ensued. On 22 January a portion of a British column was attacked at a place called Isandula or Isandhlwana, about 10 miles from Rorke's Drift on the Buffalo, by 20,000 Zulus, and completely destroyed. As soon as possible after the news of the disaster reached England, strong reinforcements were sent out, and on 4 July following the Zulu army was totally defeated at Ulundi. On 28 August Cetewayo was captured. Meanwhile Sir Garnet (later Lord) Wolseley had arrived with supreme military and civil authority in this part of Africa, and the Zulu territory was parceled out by him among several chieftains who were placed under the paramount supremacy of the British government, and were not to be allowed to keep up standing armies or to import firearms or ammunition. British residents were appointed, one in North and one in South Zululand. In 1883 Cetewayo was restored to a portion of his dominions, but was opposed by some of the chiefs. After severe fighting he placed himself in the hands of the British at Ekowe or Eshowe, where he died in 1884. Subsequently the Boers of the Transvaal made themselves masters of a considerable portion of the territory and incorporated it with their own republic. In 1885 the British assumed a protectorate over the coast of the country and in 1887 annexed all the rest. Tongaland was later incorporated with Zululand and was annexed with it to Natal. An uprising among the Zulus occurred in 1906 and its leader Dinizulu was captured and later tried for high treason. He was imprisoned but afterward was pardoned and pensioned. Pop. about 219,606, of whom the whites number about 1 per cent. Consult Ingram, J. F., 'Natalia: History of Natal and Zululand' (1897); Stuart, J., 'A History of the Zulu Rebellion' (1906; new ed., 1913).

ZUMALACARREGUI, thoo-mä"lä-kä'rrägē, **Tomas**, Spanish soldier and Carlist leader, b. Ormastegui, province of Guipuzcoa, 1788; d. Segama, Navarre, 23 June 1835. He distinguished himself in the war of independence, subsequently entered the regular army, became a lieutenant-colonel in 1825, and later colonel. Ferdinand VII made him governor of Ferrol, but Cea Bermúdez, the prime-minister, removed him. Soon after the death of Ferdinand, he became the head of the Carlist bands in the Basque provinces and Navarre. With great

tration was, according to the historian, Juan de Torquemada, one of prudence and wisdom. A dispute with the audiencia of Guadalajara, however, on a point of jurisdiction, nearly precipitated civil war upon the colony. Philip II, on the basis of reports circulated by his foes, finally removed him in 1589, and directed Pedro Romano, the bishop of Tlaxcala, to investigate Zúñiga's government. Romano persecuted Zúñiga with great cruelty until 1596, when the latter sailed for Spain, where he was successful in getting revoked the sentence of confiscation pronounced against him.

ZÜÑIGA, Dionisio de, Central American missionary: b. Guatemala, about 1550; d. Chiapa (now in southern Mexico), about 1620. He became a Dominican in Chiapa province, and for the greater part of his life was a missionary among the Quiche Indians. He wrote a grammar of the Quiche language and prepared also in Quiche a volume of sermons and several religious treatises, besides translating Francisco Viana's works, originally written in the dialect of Vera Paz.

ZÜÑIGA Y AZEVEDO, ē-thā-vā'thō, Gaspar de, COUNT OF MONTEREY, Spanish viceroy in America: b. Andalusia, about 1540; d. Lima, Peru, 10 Feb. 1066. He took vice-royal charge of Mexico, 5 Nov. 1595, and in 1596 sent an expedition in command of Sebastian Vizcaino for the exploration and occupation of Lower California. Vizcaino was hampered by lack of provisions, and returned after accomplishing little. By royal order, he was again sent out by Zúñiga in 1602, when he explored the coast of Upper California. In 1597 Zúñiga drove out William Park, an English pirate who had taken possession of Campeche. Among other expeditions organized by him was one commanded by De Oñate (see ONATE, JUAN DE) and Zaldivar to take New Mexico. During his administration in Mexico he was a benefactor of the natives. In 1603 he became viceroy of Peru, though he did not enter Lima until 1604.

ZUNZ, tsunts, **Leopold,** German Jewish scholar: b. Detmold, Germany, 10 Aug. 1794; d. Berlin, 17 March 1886. He studied at the university, to 1839 he was in Prague as preacher at the synagogue of Berlin; and in 1824–32 was editor of the *Spenersche Zeitung*. From 1835 to 1839 he was in Prague as preacher at the synagogue there, but in 1839 returned to Berlin to become director of the normal seminary, a position he held until 1850. In 1845 he was made a member of the board of commissioners for the promotion of the educational interests of the Jews. His writings are remarkable, in their age, for their broad view, their grasp of the subject, their clearness of presentation and their charm of language. He was the first to take up the scientific study of the Jews' rabbinical literature in his 'Etwas über die rabbinische Litteratur,' published in 1818; and his 'Die gottesdienstlichen Vorträge der Juden' (1832) is considered the authoritative work on the biblical exegesis and the homiletics of the rabbinical writings. Among his other works are 'Die Namen der Juden' (1836); 'Die synagogale Poesie des Mittellaters'; and 'Litteraturgeschichte der synagogalen Poesie' (1865).

ZURBARAN, thoor-bā-rān', **Francisco de,** Spanish painter: b. Fuente de Cantos, Estremadura, 7 Nov. 1598; d. Seville, 1662. He was educated in the school of Juan de Roëlas in Seville, and early formed his style on that of Caravaggio. He is thence frequently known as the Spanish Caravaggio. He first brought himself into notice by a series of pictures for the chapel of Saint Peter in the cathedral of Seville, illustrating the life of the titular apostle; and about 1625 he executed his celebrated picture of 'The Glory of Saint Thomas Aquinas' (Seville Museum), which is esteemed his masterpiece, and one of the finest works in Spain. Another famous series is his 11 pictures illustrative of the life of Saint Jerome painted for the monastery of Guadalupe. No less famous is his series of three pictures in the monastery of Santa Mariá de los Cuevas, in Seville, which were produced on his return from Guadalupe. These pictures, which are now in the Seville Museum, represent the 'Virgin Extending her Mantel over a Group of Carthusian Monks'; 'Saint Hugo Surprising the Monks at a Secret Feast in the Refectory'; and 'Saint Bruno in Conversation with Pope Urban II.' His 'Crucifixion' (1527) in the church of San Pablo is a notable picture. As early as 1633 he signed himself painter to the king. In 1650 he executed for the palace of Buen Retiro the 'Labors of Hercules' in 10 pictures, now in the Madrid Museum. From this time on he seems to have been a great favorite at the court, though he continued to paint monks and church dignitaries with great spirit and faithfulness to truth, which have gained for him the position of one of the three greatest of Spanish painters. Though he painted several large compositions, he preferred small and simple ones, generally religious in subject. He especially made studies of the Spanish friar. His works are to be seen in some private collections, and in the galleries of Saint Petersburg, Pesth, Munich, Paris and London. Consult Bermudez, 'Diccionario de los más ilustres profesores' (1800); and Lefort, 'La peinture espagnole' (1894).

ZÜRICH, zoo'rik, Switzerland; (1) a city, capital of the canton of the same name, situated at the northeast extremity of the lake of the same name. It is divided by the Limmat into unequal parts, forming an upper and lower town, connected with their suburbs by several bridges. The streets in the oldest quarters are narrow, crooked and dark, but have undergone considerable improvement. The principal buildings are the cathedral or Grosse Münster, on a hill near the right bank of the Limmat, a heavy massive structure in the Byzantine style; the Fraumünster, on the left bank of the river; Saint Peter's Church, with a fine tower and clock; the town-house; the town library, containing 130,000 volumes; the museum, with a collection of home and foreign periodicals, and a rich library; the university; the new Swiss Polytechnic School; the arsenal; the music buildings; the railway station; the theatre and the post office. Two public promenades add to the attractions of the city, besides a botanical garden and many smaller parks and walks connected with a variety of institutions, public and private. Manufactures of silk and cotton, including dyeing and calico-printing, are

extensive; those of candles, soap, tobacco, paper, leather and machinery are also considerable. Besides the university, founded in 1832 and having a professional staff of 150, and over 1,300 students in theology, law, medicine and philosophy, there are the Polytechnic School which is maintained by the government and in 1917 had a teaching staff of 262, Schools of medicine and of arts, secondary and elementary schools of all kinds, deaf and dumb and blind asylums, orphan and several other hospitals. Learned and other societies of various descriptions abound. Zürich is of great antiquity and early became a Roman station. In 1219 it was declared a free imperial city. The preaching of Zwingli in the cathedral made it the centre of the Swiss Reformation. Here, in 1443, the Swiss defeated the Austrians, and here also, in 1799, the Russians were defeated by the French. The Treaty of Zürich, signed here 10 Nov. 1859 by the plenipotentiaries of France and Austria, closed the Franco-Italian war by Austria's abandonment of her right to Lombardy. Pop. (1918), estimated 213,900. (2) A northern canton bounded north by Schaffhausen and the grand duchy of Baden, west by Aargau, south by Zug and Schwyz, and east by Saint Gall and Thurgau; area, 666 square miles. Though not properly mountainous, it has on its south and southeast frontiers several lofty ridges, remarkable for their parallelism. Except the Lägern and adjoining heights, they have their longer axis from southeast to northwest and form a succession of terraces lowering gradually toward the north. The general slope is toward the left bank of the Hornli and the Schauenberg, both in the east. The general slope is toward the left bank of the Rhine, which drains part of it directly and part indirectly, by the Thur, Töss, Glatt and Limmat. Of the lakes, about 40 in all, the most important are those of Zürich, Greiffen, Pfeffikon, Türler and Katzen. The climate is on the whole temperate, but mists are prevalent, particularly on the lower grounds. In some parts the prevailing rock is the Jura limestone, but a more recent formation, consisting chiefly of marl and sandstone in almost horizontal strata, is still more largely developed. One remarkable feature is the immense number and magnitude of the granite boulders which cover the surface. The minerals are few and of little value. The soil, with the exception of a few favored spots, is far from fertile and hence, though the arable land is comparatively large and carefully cultivated, the corn produced falls short of the consumption. In some districts a wine of tolerable quality is produced. Wood seldom forms forests, but occupies many scattered patches and hedgerows. Game is scarce, fish almost superabundant. In no canton have manufactures made more progress. The great staples are silk and cotton goods. The inhabitants are almost all Protestants, and education is very generally diffused. Zürich was admitted into the Swiss Confederation in 1351 and readmitted in 1450, after a 10 years' alliance with Austria. The government, formerly somewhat aristocratic, became decidedly democratic in 1831. A new democratic constitution was adopted in 1869. Zürich holds the first place in the Swiss Confederation. Pop. about 550,000. (3) One of the principal lakes of Switzerland, chiefly in the canton of Zürich, but partly also in Schwyz. It forms a long irregular curve, bending round from southeast to northwest, convex on the south and concave on the north side; greatest length, about 27 miles; greatest breadth, two and one-half miles; greatest depth, 469 feet. Its scenery is distinguished not so much for grandeur as for beauty. The mountains around, nowhere exceeding 1,700 feet above the lake, which is itself 1,342 feet above sea-level, commence in wooded heights and descend to the water's edge in gentle slopes, covered with vineyards, orchards, gardens, cultivated fields and verdant meadows, and studded over with country-seats and smiling villages. A considerable traffic is carried on upon the lake by means of sailing vessels and numbers of steamers. It is well supplied with fish. Its chief feeder is the Linth Canal (completed in 1816), communicating with the Wallenstätter-see. It discharges itself at the town of Zürich by the Limmat.

ZURITA Y CASTRO, thoo-rē'tä ē käs-trō, **Geronimo**, Spanish historian: b. Saragossa, 4 Dec. 1512; d. 3 Nov. 1580. He was educated at Alcalá, and in 1543, he was sent to Germany on a diplomatic mission to Charles V by the inquisitor-general of Aragón. Subsequently he was made councillor of state and secretary to Philip II. Appointed chronicler of Aragón, he traveled in quest of data through Spain, Sicily and Italy, and finally in 1562–80 published in six volumes his 'Anales de la Corona de Aragón' (continued by Argensola and Blasco-Lanuza 1622). He also made important corrections, in, and additions to, Lopez de Ayala's (see AYALA, LOPEZ DE) 'Crónicas de los Reyes de Castillas.' For a biographical sketch and some correspondence, consult Dormer, 'Progressos de la Historia en Aragon' (1860). The 'Anales' was looked upon as a work of very great importance during more than a century after its publication, and several editions of it have been issued, notably in 1558, 1610 and 1669, and annotated editions of it have been published within the past 25 years.

ZÜTPHEN, züt'fĕn, Netherlands, a former fortified town in the province of Gelderland, 27 miles northeast of Arnhem on the right bank of the river Yssel, where it is joined by the Berkel. Its chief edifice is the 12th century church of Saint Walpurgis. The town was at one time a member of the Hanseatic League, and had a considerable foreign trade. It still has an active home trade, more especially in sending grain and timber, both rough and prepared, down the Yssel. Pop. about 24,000.

ZUYDER ZEE. See ZUIDER-ZEE.

ZWEIBRÜCKEN, tsvī'brük-ĕn (Latin, *Bipontium*; French, *Deux-Ponts*, "Two Bridges"), Germany, a town in the Rhine-Palatinate, on the Schwarzbach River, 54 miles southwest of Mannheim. It was the capital of the mediæval Duchy of Zweibrücken, until the end of the 18th century. It is well built and has Protestant and Roman Catholic churches and a synagogue; gymnasium, a *realschule* and several other schools; courts and public offices occupying the former ducal palace; an orphanage and hospitals; manufactories of silk plush, machinery, chicory, tacks, chains, leather, etc.,

and a trade in corn and cattle. The edition of the classics known by the name of 'Bipont' was published here in 1779 and subsequent years. Pop. about 15,250.

ZWEMER, Samuel Marinus, American missionary: b. 12 Aug. 1867 at Vriesland, Mich. He graduated at Hope College, Holland, Mich., A.B. 1887; B.D., New Brunswick Theological Seminary 1890. He was ordained a minister of the Reformed Church in America 1890, and became a missionary at Busrah, Bahrein and other stations in Arabia 1891–1905, afterward residing in Cairo, Egypt. He was the organizer and chairman of the Mohammedan Missionary Conference, Cairo, 1906, and has traveled extensively in Moslem lands. He is the author of 'Arabia the Cradle of Islam' (1892); 'Topsy Turvy Land' (1902); 'Raymond Lull' (1904); 'Moslem Doctrine of God' (1906); 'Islam, a Challenge to Faith' (1907); 'The Moslem World' (1907); 'The Moslem Christ' (1911); 'The Unoccupied Mission Fields' (1910); 'Zigzag Journeys in the Camel Country' (1912); 'Childhood in the Moslem World' (1915); 'Mohammed or Christ' (1915); 'Life of William Borden' (1916); 'The Disintegration of Islam' (1917). He is editor of *The Moslem World*, a quarterly review, New York.

ZWICKAU, tsvik'ow, Germany, a town of Saxony, on the west bank of the Mulde, 60 miles west-southwest of Dresden. It has several interesting churches, among them two ancient Gothic types recently restored, that of Saint Mary, dating from the 15th century; a gymnasium with a library; a town hall built in 1581, which has archives dating from the 13th century, and an old castle converted into a penitentiary. The chief source of its wealth is the rich coal beds in the vicinity, employing 8,000 miners, and yielding annually 2,500,000 tons of coal. The mines were known as early as 1348 but have been worked only since 1826. There are also manufactures of linen and cotton goods, dyes and chemical products, numerous tanneries, dye-works, bleach-fields, oil, saw and other mills, and a considerable transit and general trade. It was the birthplace of Robert Schumann, the composer. See ANABAPTISTS for the "Prophets of Zwickau." Pop. about 73,538.

ZWINGER, tsving'ĕr, **Theodor,** Swiss scholar: b. Basel, 2 Aug. 1533; d. there, 10 March 1588. He studied at Basel and at Paris, and after a course in medicine at Padua, became a member of the Basel medical faculty. He lectured there on Greek in 1565–71 and subsequently on ethics, and from 1580 was professor of the theory of medicine. Zwinger was a type of the universal scholarship of that time, and wrote a 'Theatrum Vitæ Humanæ' (1565), a kind of general encyclopædia, then regarded as a marvel, but now having only a bibliographical interest. His 'Methodus Apodemica' (1578), contains material valuable for local history. Consult 'Athenæ Rauricæ' (1778), which contains a list of his writings.

ZWINGER, The, a public building in Dresden, containing a valuable collection of works of art and scientific treasures. The word Zwinger is a general name for a prison or any confined place.

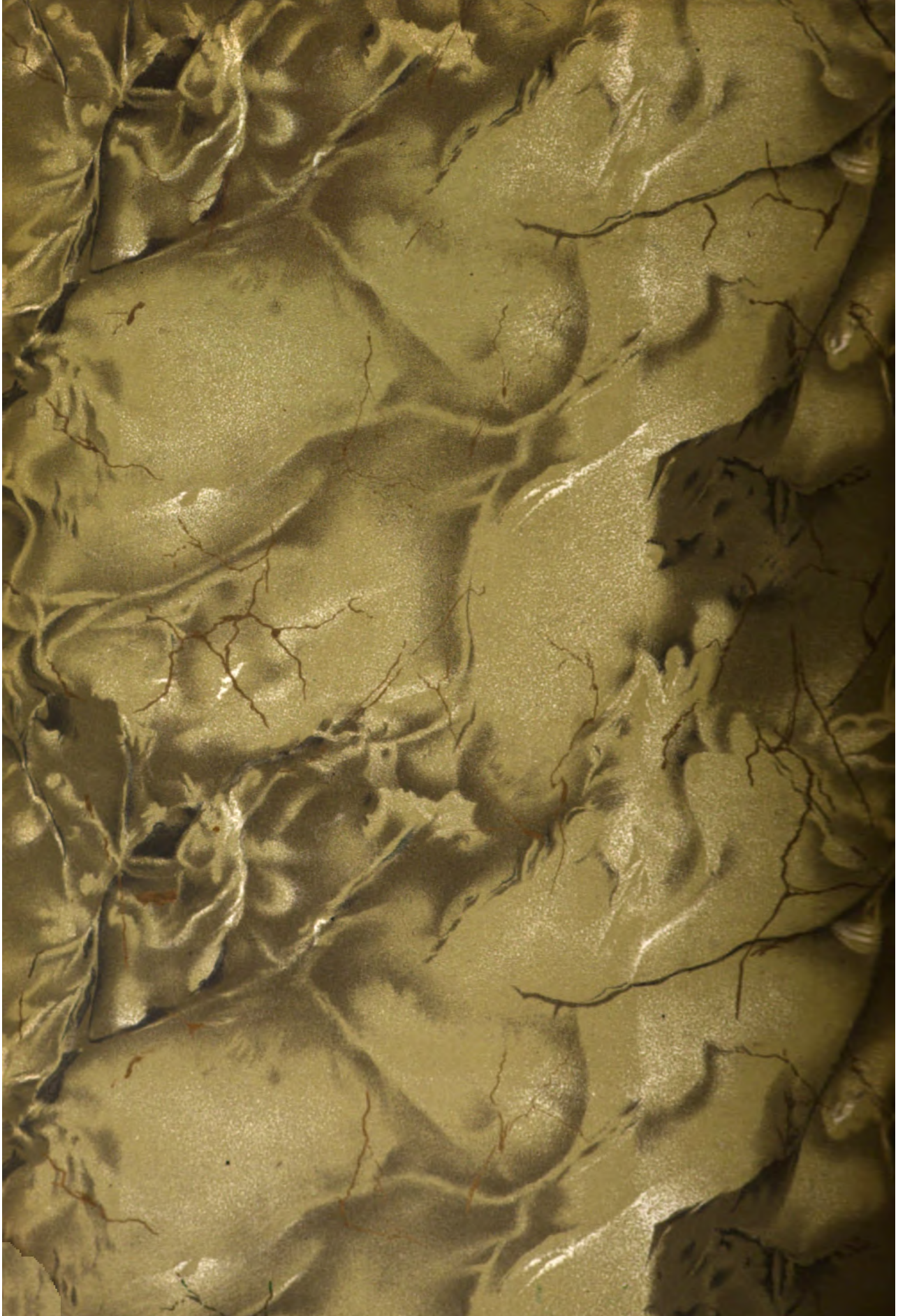
ZWINGLI, zving'lĕ, Ger. tsving'lĕ, or **ZUINGLIUS ULRICH,** a celebrated Swiss reformer, was a contemporary of Luther (q.v.), and was born at Wildhaus, canton of Saint Gall, on 1 Jan. 1484; d. Kappel, 11 Oct. 1531. Ulrich was the third of eight sons of the bailiff of that place. He studied at an early age in Basel and Bern, and continued his studies in Vienna, where he occupied himself with philosophy, and again in Basel, where he devoted his attention to theology, under the direction of Wyttenbach. In 1506 Zwingli became parish priest at Glarus, and here employed his time, as Luther had done in the Augustine monastery at Erfurt, in the diligent reading of the Holy Scriptures. He copied the epistles of Saint Paul in the original Greek, and even learned them by heart —an acquisition which afterward proved of great service to him in his public discussions. He accompanied the forces of Glarus during the campaigns of 1512, 1513 and 1515, in Lombardy, in the cause of the Pope against the French, in the capacity of chaplain, and was rewarded for this service by the grant of a pension from the Pope. In 1516 he became preacher in the convent of Einsiedeln, then a celebrated place of pilgrimage. Here he began to make known publicly his ideas of reform, preaching against the pilgrimage of Einsiedeln, which he termed an abuse and a corruption of the doctrine of the Christian Church, and calling upon the bishops of Sion and Constance to promote a reformation of religious doctrines, upon those points in which Zwingli considered that the Church had departed from the primitive teaching. Up to this time, however, his ideas of innovation excited no rebuke upon the part of the authorities, and he was, not long after, invited to Zürich, and entered on his office of preacher in the cathedral 1 Jan. 1519, with a discourse in which he declared himself for the use of the simple Scriptures without regard to the prescribed texts and lessons. At Zürich Zwingli delivered a series of sermons on the Holy Scriptures; and these discourses in which he inveighed against what he declared to be the errors and superstition of the times, laid the foundation for his future work of reformation. The occasion which launched him on his career was similar to that which had aroused Luther. In 1518 Bernadin Samson, a Franciscan monk of Milan, appeared in Switzerland to preach the indulgence proclaimed by Leo X to all who should subscribe alms to the building of Saint Peter's Church at Rome. Zwingli, who was then preaching at Einsiedeln, opposed him there, and afterward in Zürich, with all the power of his eloquence, and brought the indulgences into so much odium that Samson was not even permitted to enter Zürich; and the Council of Zürich finally obtained from the Papal Nuncio the recall of Samson to render an account of his mission at Rome. From this time Zwingli gradually went further in his plans, supported by the Zürichers. In Zürich his innovations were so far promoted by the government that in 1520 a decree was issued ordering that the Holy Scriptures should be taught "without human additions." In 1522 the reformation was extended to external ceremonies. In this year Zwingli was forbidden to preach by the bishop of Constance. In it also he wrote his first work against the fasts of the Church and began the

study of Hebrew. In 1523 the government in Zurich invited all theologians to a public conference in Zurich, to convict, if possible, Zwingli of an error in doctrine. About 600 persons, clergy and laymen, were present at this disputation. Zwingli exhibited his opinions in the form of 67 propositions, which were to form the subject of discussion. The celebrated John Faber, the vicar-general of the bishop of Constance, refused to discuss any of Zwingli's propositions save the last one, which denied the supreme authority of the Church, whereupon the Council of Zurich decreed that Zwingli had not been convicted of error or heresy, and "might continue to freely announce the holy gospel and the Word of God according to the new order." In a second dispute Zwingli urged his objections to images and the mass and the former were soon afterward removed from the churches by order of the council and the latter abolished. In 1524 Zwingli married Anna Reinhard, a widow, and the next year published his commentary on "True and False Religion." The Reformation in Switzerland was now fixed upon a firm base; and Zwingli continued the work with undiminished zeal, warmly supported by the cantons which espoused the Protestant cause. The religious orders were suppressed and all questions of marriage were placed under the jurisdiction of the civil tribunals, as well as the administration of the Church revenues. In general, Zwingli agreed in his opinions with the German reformers; like them he assumed the Bible as the only rule of faith, rejected the Papacy, attacked the authority of the priesthood and declared that his object was to restore the Church to the simplicity of primitive times. His views differed on some points from those of Luther, particularly in regard to the real presence, and on some less important matters relative to the liturgy. In order to remove this wall of partition from between the two parties which adopted the new doctrines, a meeting between the Saxon and Swiss reformers was held at Marburg (1–3 Oct. 1529) at the suggestion of Philip, the Landgrave of Hesse. The former were represented by Luther and Melanchthon, the latter by Zwingli and Œcolampadius. Although a complete union was not effected, yet a convention was agreed upon, the first 13 articles of which, containing the most important matters of religious faith, were recognized by both parties; and the 14th declared that, though they could not agree as to the real presence of Christ in the eucharist, they would behave reciprocally in the spirit of Christian charity. In 1531 an open war broke out between Zurich on the one side and the Catholic cantons of Lucerne, Schwyz, Uri, Unterwalden and Zug on the other; and Zwingli was commanded to take the field, bearing the banner of the canton, which it had been usual for an ecclesiastic to support. A battle ensued at Kappel, on 11th October. But the enemy were more than twice as strong as the Zurichers and under better officers; the latter were, therefore, defeated and Zwingli was among the slain. The spot where he fell is marked by a monument. The Reformed Church in Switzerland afterward received from the hands of Calvin (q.v.) its present organization. The collected works of Zwingli were published at Zürich in 1545. A complete collection of Zwingli's writings was also published at Zürich in eight volumes in 1828. E. Zeller has attempted to deduce Zwingli's doctrines from his writings, 'Das theologische System Zwinglis dargestellt' (Tübingen 1853). There are numerous biographies of this reformer, for example, 'Huldreich Zwingli, sein Leben und Wirken' (1895–97) by Stähelin. Consult also Jannsen, 'History of the German People' (1903).

GEORGE E. RINES.

ZWOLLE, zwŏl'lĕ, Netherlands, capital of the province of Overyssel on the Zwarte Water, 60 miles northeast of Amsterdam. Formerly it was a member of the Hanseatic League and was a strong fortress with 11 bastions and three forts. It is a well-built city, with handsome boulevards on the site of its ancient ramparts, and three fine suburbs. Its corn market is one of the best in Holland. Its chief buildings are Saint Michael's Church, dating from the 15th century, a large and splendid building with a famous organ; the government buildings with the provincial archives; the town-hall, dating from 1448, but since remodeled; and the courts of justice. The town has a Latin school, a school of navigation, an industrial school, a public library with rare works on geography and local history, a museum of natural history, a theatre, etc. Zwolle has communication with the sea by means of the Willemsvaart Canal and is the centre of the northern and eastern canal systems of the Netherlands. It manufactures oil, spirits, iron goods and linens, carries on shipbuilding and a trade in corn and cattle. In a monastery in the neighborhood Thomas à Kempis lived and died. Pop. 34,224.

ZYLONITE, XYLONITE, same as celluloid. See CELLULOID.

ZYLONITE, a material made by treating cellulose or vegetable fibre with nitric and sulphuric acids, dissolving the resulting pulp in camphor and then drying it. In its liquid state, collodion, it was used in surgical operations as early as 1848; in 1855 zylonite was manufactured by Alexander Parkes of Birmingham, England, and put on the market as parkesine. About the same time several factories for the manufacture of zylonite were established in France and Germany, England and the United States. In 1869 celluloid (q.v.), a kind of zylonite, was first manufactured and has entirely superseded all other forms of zylonite.

ZYMOTIC DISEASE, any disease caused and continued by a living germ introduced from without into the body and there multiplied. The term was formerly applied to epidemic and endemic contagious diseases because they were supposed to be produced by some morbific principle acting on the system like a ferment (Greek ζύμη). The chief of such diseases include measles, scarlet fever, smallpox, typhus, diphtheria, whooping-cough, croup and erysipelas (qq.v.). With the development of present theories and scientific knowledge of infectious disease, the term zymotic has been almost abandoned. See BACTERIOLOGY; DISEASE, GERM THEORY OF; MALARIA; NOSOLOGY.